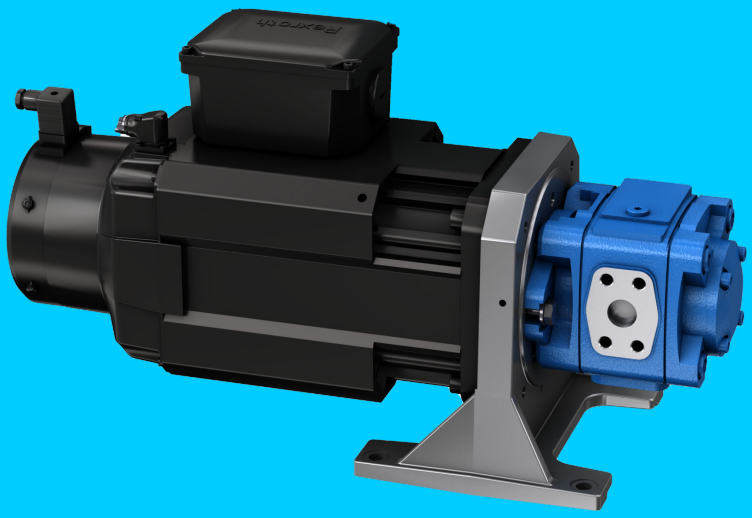
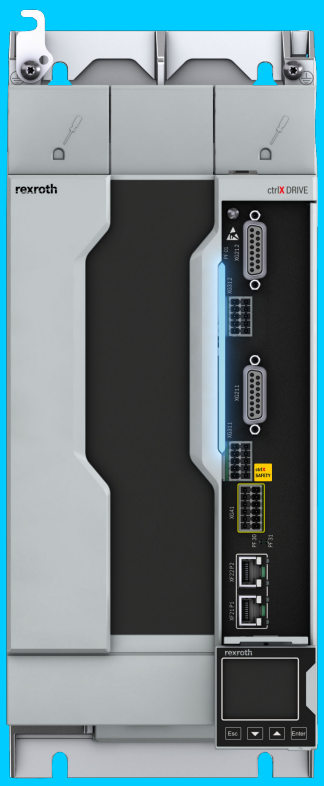
rexroth
A Bosch Company

Operating Manual

Sytronix SvP 7030 IMC

Variable-speed pump drive





RE 62312-B, 03.2022

Verbindlichkeit

Die angegebenen Daten dienen allein der Produktbeschreibung und sind nicht als zugesicherte Eigenschaften im Rechtssinne zu verstehen. Änderungen im Inhalt der Dokumentation und Liefermöglichkeiten der Produkte sind vorbehalten.

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1 About this documentation

1.1 Validity of the documentation

This documentation is valid for the following Sytronix systems:

- SvP 7030 IMC

This documentation is intended for engineers, fitters, operators, service technicians and plant operators.

This documentation contains important information on the safe and proper mounting, transport, commissioning, operation, use, maintenance, demounting and simple troubleshooting of the Sytronix system SvP 7030 IMC.

- Read this documentation thoroughly, especially Chapter 2 “Safety instructions“ and Chapter 3 “General notes on damage to property and damage to the product“, before working with the Sytronix system.

1.2 Required and supplementary documentation

- The product must not be commissioned until you have been provided with the documentation marked with the book symbol 🕮 and you have understood and observed it.

Table 1: Required and supplementary documentation

		Title	Document no.	Document type
System	🕮	Sytronix SvP 7030 IMC, variable-speed pump drives	RE 62312-FK	Functional description
ctrlX DRIVE	🕮	ctrlX DRIVE Drive Systems	R911386579	Project Planning Manual
	🕮	ctrlX SAFETY "Safe Torque Off" Safety Option in ctrlX DRIVE	R911383774	Application Manual
		Security Manual Electric Drives and Controls (IT Security)	R911342562	Project Planning Manual
	🕮	ctrlX DRIVE Runtime AXS-V03 Functions	R911410073	Application Manual
	🕮	ctrlX DRIVE, Diagnostic Messages of Runtime AXS-V03RS	R911409763	Reference Book
	🕮	ctrlX DRIVE, Parameters of Runtime AXS-V-03RD	R911409808	Reference Book
Motors	🕮	Rexroth Sytronix SvP 70xx Motor-Pump Unit MPA02	R911387041	Operating instructions
	🕮	MS2N Synchronous Servomotors	R911347583	Project Planning Manual
Pumps		Internal gear pump, type PGH.-3X	RE 10227	Data sheet
		Internal gear pump, type PGH.-3X	RE 10227-B	Operating instructions
		Internal gear pump PGM series 4X	RE 10235	Data sheet
		Internal gear pump PGM series 4X	RE 10235-B	Operating instructions
		Axial piston units for variable-speed drives A10FZO, A10VZO, A10FZG and A10VZG	RE 91485	Data sheet
		Axial piston units for variable-speed drives A10FZO, A10VZO, A10FZG and A10VZG series 10	RE 91485-01-B	Operating instructions

		Title	Document no.	Document type
Miscellaneous		Rexroth Sytronix Mounting and Commissioning Axial Piston Variable Pump - A10VZO/A10VSO/A4VSO	R911341629	Mounting instructions
		Control Cabinet: Air Conditioning, EMC, Design, IP Code, Electrics, IndraDrive, Rexroth EFC/Fv, Sytronix	R911344988	Project Planning Manual
		Rexroth Connection Cables IndraDrive and IndraDyn	R911322949	Selection data
		Pressure transducer for hydraulic applications, type HM20	RE 20372	Data sheet
		Pressure transducer for hydraulic applications, type HM20	RE 20272-B	Operating instructions

1.3 Representation of information

In order that this documentation allows you to work directly and safely with your product, standardized safety notes, symbols, terms, and abbreviations are used. For a better understanding, they are explained in the following sections.

1.3.1 Safety instructions

In this documentation, safety instructions are contained in chapter 2 and chapter 3 and wherever sequences of actions or instructions are explained which bear the risk of personal injury or damage to property. The hazard avoidance measures described must be observed.

Safety instructions are structured as follows:

⚠ WARNING	**Type and source of danger! and consequences in the case of non-observance** – Hazard avoidance measures

- **Warning symbol:** draws attention to a hazard
- **Signal word:** identifies the degree of hazard
- **Type and source of danger!:** identifies the type or source of the hazard
- **Consequences:**describes the consequences in the case of non-observance
- **Precautions:**states, how the hazard can be avoided

Hazard classifications according to ANSI Z535.6-2011

⚠ DANGER	In case of non-compliance with this safety instruction, death or serious injury **will** occur.
⚠ WARNING	In case of non-compliance with this safety instruction, death or serious injury **could** occur.
⚠ CAUTION	In case of non-compliance with this safety instruction, minor or moderate injury **could** occur.
NOTICE	In case of non-compliance with this safety instruction, property damage **could** occur.

1.3.2 Symbols

The following symbols indicate notices which are not safety-relevant but increase the comprehensibility of the documentation.

If this information is disregarded, the product cannot be used or operated in an optimum manner.

- Individual, independent action

→ Numbered instruction: The numbers indicate that the actions must be carried out one after the other.

1.3.3 Designations

The following terms are used in this documentation:

Table 2: Designations

Designation	Meaning
Drive controller	Device. The drive controller basically consists of the power section and the control section
AXS	Firmware for drive controllers
A10FZO	Axial piston pump, fixed displacement
HM20	Pressure transducer
IndraWorks Ds	Bosch Rexroth software tool for drive commissioning
MPA02	Motor-pump unit consisting of internal gear pump and MS2N motor
MS2N	Servo motor
PGH/PGM	Internal gear pump, fixed displacement
SvP system	Servo-variable pump system
Sytronix	Variable-speed pump drives
XCS	Single-axis converter

1.3.4 Abbreviations

The following terms are used in this documentation:

Table 3: Abbreviations

Designation	Meaning
CPU	Central Processing Unit (processor)
EMC	ElectroMagnetic Compatibility
ESD	ElectroStatic Discharge
IMC	Injection Molding Control
n	Speed
p	Pressure
Q	Flow
RE	Rexroth document in English language
TF	Technology Function
Vg	Displacement
PE	Protective Earth
SW	Software
VAC	Volts of Alternating Current (AC voltage)
VDC	Volts direct current (DC voltage)

2 Safety instructions

2.1 About this chapter

The Sytronix system is designed and manufactured according to the generally accepted code of practice. However, there is still a risk of personal injury and damage to property if you do not observe this chapter and the safety instructions in this documentation.

- Read this documentation completely and thoroughly before working with the Sytronix system.
- Keep this documentation in a location where it is accessible to all users at all times.
- Always include the required documentation when you pass the product on to third parties.

2.2 Intended use

This product is an electro-hydrostatic drive system. You may use the product as follows:

- For controlling a flow with alternating pressure control functionality (p/Q control).
- As a pure high-precision hydraulic pressure supply.

The Sytronix system is intended exclusively for being integrated in a machine or installation or for being assembled with other components to form a machine or system. The product may be commissioned only if it is integrated in the machine/system for which it is designed.

Make sure that components supplied by the customer, e.g. electric drives, are sufficiently dimensioned.

Observe the technical data, operating conditions and performance limits according to the data sheet and the order confirmation.

The product is intended exclusively for professional use and not for private usage.

Operation according to the intended use also implies that you have read and understood this documentation completely, especially chapter 2 “Safety instructions“.

No plausibility checks and no checks of actual values (pressure and speed) are provided in the Sytronix system.

Make sure that the plausibility check is executed in the machine control.

For application-specific adjustment of the parameters within the framework of initial commissioning, please get in touch with your technical contact at Bosch Rexroth.

2.3 Improper use

Any use other than described in the section “Intended use” is considered as improper and is therefore not permitted.

The installation or use of inappropriate products in safety-relevant applications could result in unintended operating states in the application which in turn could cause personal injuries and/or damage to property. Therefore, please only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product. For example, in explosion-protection areas or in safety-related parts of a control (functional safety).

Bosch Rexroth AG does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use. Improper use of the product includes:

- If you do not adhere to the technical data, operating conditions and performance limits specified in the data sheet and given in the order confirmation.
- If you do not observe national EMC regulations during operation for the application at hand. The manufacturer of the system or machine is responsible for complying with the limit values stipulated in national regulations (European countries: EU Directive 2014/30/EU (EMC Directive); USA: See National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA) as well as regional engineering regulations.
- If you use the Sytronix system SvP 7030 with a conventional MS2N motor in a potentially explosive atmosphere.

2.4 Qualification of personnel

The activities described in this documentation require basic knowledge of mechanics, electrics and hydraulics as well as knowledge of the appropriate technical terms. In order to ensure safe use, these activities may only be carried out by an expert in the respective field or an instructed person under the direction and supervision of an expert.

Experts are those who are able to recognize potential hazards and apply the appropriate safety measures due to their professional training, knowledge and experience, as well as their understanding of the relevant requirements pertaining to the work to be undertaken. An expert must observe the relevant specific professional rules and have the necessary expert knowledge. Expert knowledge means for example:

- The ability to read and completely understand electrical and hydraulic circuit diagrams,
- Having knowledge of the wiring of electrical components, in particular, completely understanding the correlations regarding safety equipment and
- Knowledge of the function and structure of hydraulic components as well as of their installation and connection,
- Basic knowledge of open and closed-loop control technology and the ability to parameterize application software

Bosch Rexroth offers training courses that support your qualification in specific fields. You can find an overview of training contents on the Internet at: ➦https://www.boschrexroth.com

2.5 General safety instructions

- Observe the valid regulations on accident prevention and environmental protection.
- Observe the safety regulations and provisions of the country in which the product is used/applied.
- Exclusively use Rexroth products in technically perfect condition.
- Observe all notices on the product.
- Persons who install, commission, operate, demount or maintain Rexroth products must not consume any alcohol, drugs or pharmaceuticals that may affect their ability to respond.
- Only use accessory and spare parts released by the manufacturer in order to rule out personnel hazards arising from unsuitable spare parts.
- Comply with the technical data and ambient conditions specified in the product documentation.

- If unsuitable products are installed or used in safety-relevant applications, unintended operational states can occur in these applications, which can cause personal injury and damage to property. Therefore, please only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product.
- You may commission the product only when it has been established that the final product (for example, a machine or system), in which the Rexroth product is installed, complies with national regulations, safety regulations and standards relevant for the application.

2.6 Product and technology-related safety instructions

⚠ WARNING	**System parts under pressure and ejecting hydraulic fluid!** When working on hydraulic systems with stored energy (e.g. accumulators) hydraulic components may still be under pressure even after the pressure supply was switched off. During installation and demounting, components or parts may be hurled around and cause personal injuries and/or damage to property. There is moreover the risk of serious injury caused by a powerful, ejecting hydraulic fluid jet. – Before working on the hydraulic product ensure that the hydraulic system is depressurized and the electrical control de-energized. – Completely depressurize machines and systems before working on hydraulic products.
⚠ WARNING	**Non-compliance with functional safety!** Hydraulic components control movements in machines or systems. In the event of mechanical and electrical faults, e.g. power supply failure due to lightning or fluctuations in the power supply, the machine can start up unexpectedly and perform uncontrolled movements and thus cause personal injuries. – When setting up your circuit, observe functional safety, e.g. according to EN ISO 13849. – If necessary, fit light barriers or safety guards for protection against dangerous movements. – Observe the notes in the project planning manual and in the data sheet with regard to protection and application. – If an accumulator is provided, install a check valve and an accumulator safety block.

⚠ WARNING	**Sytronix system falling down!** Sytronix systems are heavy. When improperly handled, they can fall down and cause severe injuries and crushing, because the parts can be, for example, sharp-edged, heavy, oily, loose or bulky. – Transport the Sytronix system using suitable lifting gear at the points provided for this purpose. – Ensure a stable position during transport to the place of installation. – Wear personal protective equipment when handling the Sytronix system. – Comply with the national laws and regulations regarding occupational health and safety for transporting/handling.
⚠ WARNING	**Electromagnetic interference!** Frequency converters can be disturbed by interference emitted by the machine. This can cause malfunction, which can lead to severe injuries. – Use only devices, connecting elements and electrical control cables that comply with the EMC Directive. – If required, install shielding elements. – Keep a sufficient distance to sources of radiated disturbance. – Observe the EMC limit values and notes on EMC for the electrical components of the Sytronix system.
⚠ WARNING	**Electromagnetic radiated interference!** Electrical components of the Sytronix assemblies may emit electromagnetic interference. This can cause malfunction, which can lead to severe injuries. – Keep a sufficient distance to sources of radiated disturbance. – If required, install shielding elements. – Observe the EMC limit values and notes on EMC for the electrical components of the Sytronix system.
⚠ WARNING	**Improper mounting!** Mounting of hydraulic components using mounting screws of reduced strength, improper mounting or mounting with insufficient stability may cause the hydraulic components to become loose and fall down. Consequently, hydraulic fluid may leak and lead to personal injuries and/or damage to property. Heavy hydraulic components may cause bruises or fatal injury. – Completely mount hydraulic components according to the mounting specifications using suitable mounting aids. – Mount the Sytronix system at places that are suitable to bear the weight of the system. – Observe the specified mounting and installation notes and observe the given tightening torques and bolt strengths. – Check fixing devices regularly during operation.

⚠ WARNING	**Unexpected machine movements!** Working on running systems poses a danger to life and limb. The work steps described in these operating instructions may only be performed on shut down systems. Before beginning work: – Make sure that the drive motor cannot be switched on. – Make sure that all force-transmitting components and connections (electrical, pneumatic, hydraulic) are switched off according to the manufacturer's instructions and are secured against restarting. If possible, remove the main fuse of the system. – Make sure that the system is completely depressurized. Please follow the system manufacturer's instructions. – Only qualified personnel are authorized to install the Sytronix system.
⚠ WARNING	**Lines under pressure!** Risk of injury by catapulted components or plug screws due to breakage of the weakest system component (e.g. due to missing pressure relief feature). – Do not exceed the maximum operating pressure! – Limit the pressure in the system by means of overpressure elements. – Test the system at test pressure according to ISO 4413. – Never disconnect, open or cut pressurized lines! – Before carrying out any installation or other work, depressurize the Sytronix system.
⚠ WARNING	**High electrical voltage!** Danger to life and risk of injury caused by electric shock! – The Sytronix system may only be connected by or under the supervision of a skilled electrician. – Switch off the power supply before all maintenance, repair or installation work and secure it against restarting. – Before starting installation work, plugging and unplugging connectors, and carrying out any work, switch the Sytronix system off. Secure the electrical equipment against restarting. – Before switching the control system on, check the protective conductor on all electrical devices for proper connection according to the wiring diagram.
⚠ WARNING	**Fire and explosion!** In conjunction with heat sources, leaking hydraulic fluid can result in fire or explosion. – Inspect the Sytronix assemblies for leakage. – Keep sources of heat and fire away from hydraulic oil and ensure sufficient ventilation.

⚠ WARNING	**Penetrating water and humidity!** In case of use in humid or wet environments, water or humidity may penetrate at electrical plug-in connectors or hydraulic components. This case may lead to malfunction of the pump and to unexpected movements in the system which may result in personal injury and damage to property. – Only use the Sytronix system within the intended IP protection class or lower. – Ensure before the installation that all seals and caps of the plug-in connections are present and intact.
⚠ WARNING	**Dewing!** If the device temperature is lower than the ambient temperature, dewing may occur, which can lead to malfunction and thus to a risk of injury. – Comply with the technical data and ambient conditions specified in the product documentation. – Set cooling units with set temperature to the maximum shop floor temperature, not lower! – Set cooling units with adjusting temperature setting so that the temperature inside the control cabinet is not lower than the ambient temperature. Set the temperature limitation to the maximum shop floor temperature! – Use exclusively well sealed control cabinets to rule out dewing caused by incoming warm and humid ambient air. – If control cabinets are operated with the doors open (commissioning, repairs, etc.), make sure that after the doors were closed, the drive controllers can at no time be cooler than the air in the control cabinet. For this reason, provide for sufficient circulation in the control cabinet. – Observe functional safety according to EN ISO 13849.
⚠ WARNING	**Health-damaging hydraulic fluid!** Risk of intoxication and injury! Contact with hydraulic fluids causes damage to health (e.g. eye injuries, skin damage, poisoning by inhalation and swallowing). – Always check the lines for wear and damage before any commissioning. – Wear protective gloves, goggles and suitable work clothing. – If nevertheless hydraulic fluid comes into contact with the eyes or penetrates the skin, consult a doctor immediately. – When handling hydraulic fluids, strictly observe the safety notes of the hydraulic fluid manufacturer.

⚠ WARNING	**Hot oil!** Risk of burning by hot oil that may escape during servicing. – Avoid contact with an ejecting oil jet. – Shut the system down and replace or have damaged components replaced.
⚠ WARNING	**Electromagnetic and magnetic fields!** People with active medical implants (e.g. heart pacemakers), passive metallic implants (e.g. hip prosthesis) and pregnant women might possibly risk hazards by electromagnetic or magnetic fields in the immediate vicinity of components of the electric drive and control system and the associated current-carrying conductors. Areas in which components of the electric drive and control system and associated current-carrying conductors are mounted, commissioned and operated may be dangerous to those people. – Before entering these areas, the above-mentioned persons should seek advice from their physician. – Observe the occupational safety and health regulations applicable at the site of operation, for installations equipped with components of the electric drive and control system and the associated current-carrying conductors.
⚠ CAUTION	**Formation of smoke!** Risk of breathing difficulties due to the formation of smoke caused by overloading of the electric drive motor during longer operation of the Sytronix system with excessively large flows and at excessive pressure! – Provide motor protection (e.g. overload protection, circuit breaker).
⚠ CAUTION	**Hot surfaces!** Risk of burning. The Sytronix system heats up during operation. – Let the Sytronix system cool down before touching it. – Protect yourself by wearing heat-resistant protective clothing, e.g. gloves.
⚠ CAUTION	**High noise emission during operation!** The noise emission of Sytronix systems depends, among others, on speed, operating pressure and the installation situation. In the case of an unfavorable arrangement and connection of pumps with attached components in a system, noise and hydraulic fluid noise may be generated. – Wear hearing protection during operation. – An excessive sound pressure level may indicate malfunction.

⚠ CAUTION	**Rough, slippery surface!** Hydraulic oil escaping through leaky fittings and screwed connections causes a risk of slipping. – Check fittings and screwed connections for tightness/leakage. – If necessary, retighten fittings/screws and remove escaped oil immediately.
⚠ CAUTION	**Vibration!** Possible generation of noise and consequently fatigue as well as interference with speech communication or disturbance of acoustic signals. – Where appropriate, take decoupling measures such as the installation of anti-vibration dampers and use flexible hoses.
⚠ CAUTION	**Missing equipotential bonding!** Electrostatic charging of the pump due to flowing media, an incorrect earthing concept or missing equipotential bonding may lead to malfunctions or uncontrolled movements at the machine and thus cause injuries. – Provide for correct earthing and provide for proper equipotential bonding.

2.7 Personal protective equipment

Personal protective equipment for users of the product consists of:

- Protective gloves and safety shoes for transporting the Sytronix system
- Hearing protection for working in the direct vicinity of the running Sytronix system

2.8 Obligations of the machine end-user

The operation of installations, systems and machines basically requires the implementation of a holistic IT security concept which is state-of-the-art in terms of technology. Accordingly, Bosch Rexroth products and their properties must be considered as components of installations, systems and machines for their holistic IT security concept. Unless otherwise documented, Bosch Rexroth products are designed for operation in local, physically and logically secured networks with access restrictions for authorized persons, and they are not classified according to IEC 62443-4-2.

Further information can be found in the Security Manual R911342562.

3 General notes on damage to property and damage to the product

The warranty only applies to the delivered configuration.

The warranty becomes void if the product is incorrectly mounted, commissioned or operated, not used as intended and/or handled improperly.

NOTICE

Inadmissible mechanical load!

Impact or shock forces on the Sytronix system and attached components may damage or even destroy it.

- Do not hit on the drive shaft of the unit.
- Never use the Sytronix system as a handle or step. Do not place/put any objects on top of it.

NOTICE

Foreign particles and dirt in the Sytronix system!

Risk of damage, wear and malfunctions due to ingress of dirt and foreign particles.

- During installation, ensure utmost cleanliness in order to prevent foreign particles such as welding beads or metal chips from getting into the hydraulic lines.
- Before commissioning, make sure that all hydraulic connections are tight and that all seals and closing elements of plug-in connections are correctly installed and not damaged.
- When filling the system with hydraulic fluid, filter the fluid with a suitable filtering system to minimize contamination with solid particles and water in the system.
- Do not use cotton waste or linty cloths for cleaning.
- Take care that no cleaning agents enter the hydraulic system.

NOTICE

Wear!

Wear may lead to malfunctions.

- Carry out the prescribed maintenance work at the time intervals specified in the operating instructions.

NOTICE

Environmentally harmful hydraulic fluid!

Leaking hydraulic fluid leads to environmental pollution.

- Immediately remedy any leakage.
- Dispose of the hydraulic fluid in accordance with the national regulations in your country.

NOTICE

Insufficient pressure!

If the pressure falls below the specified value, damage can occur or the product be destroyed.

- Make sure that the pressure cannot fall under the prescribed minimum value.

NOTICE	**Insufficient hydraulic fluid!** If you commission or operate the Sytronix system without or with insufficient hydraulic fluid, the control system is immediately damaged or even destroyed. – When commissioning or re-commissioning a machine or system, make certain that the housing chamber as well as the suction and working lines of the Sytronix system are filled with hydraulic fluid and remain filled during operation.
NOTICE	**Corrosion due to water and saltwater!** Contact with salt water leads to increased corrosion. Thus, mounting screws and plug screws as well as moveable components may be chemically corroded and damaged and thus cause leakage and oil getting into the environment. – So take suitable corrosion protection measures, e.g. by means of an anti-corrosion coating.

4 Scope of delivery

The Sytronix system SvP 7030 IMC basically consists of the following components:

- Motor-pump group MPA02 or motor-pump group with conventional coupling and pump mounting bracket
  - Servo motor MS2N with encoder
  - Internal gear pump PGH or PGM or axial piston pump A10FZO
  - Flange for motor/pump connection
- ctrlX DRIVE controller with integrated Sytronix firmware (with brake chopper)
- Accessories for drive controller such as braking resistor, choke, mains filter and shielding plate
- Pressure transducer HM20
- Power cable for MS2N motor
- Encoder cable

5 Product description

5.1 Performance description

An SvP Sytronix system features open-loop flow control with alternating closed-loop pressure control (p/Q control). It can also be operated as a pure, highly precise hydraulic pressure supply.

The pressure command value for the drive controller ctrlX DRIVE is set by the higher-level machine control. A pressure transducer senses the actual pressure value in the hydraulic system and feeds it back to the drive controller ctrlX DRIVE. The drive controller ctrlX DRIVE controls the speed of the servo motor so that the hydraulic pump driven by it delivers exactly the oil volume required for reaching the set pressure. Alternatively, a speed limitation value can be provided for the drive controller ctrlX DRIVE for controlling the flow. The drive controller ctrlX DRIVE then adjusts the speed of the servo motor so that the hydraulic pump driven by it delivers exactly the oil volume that corresponds to the set value.

5.2 Device description

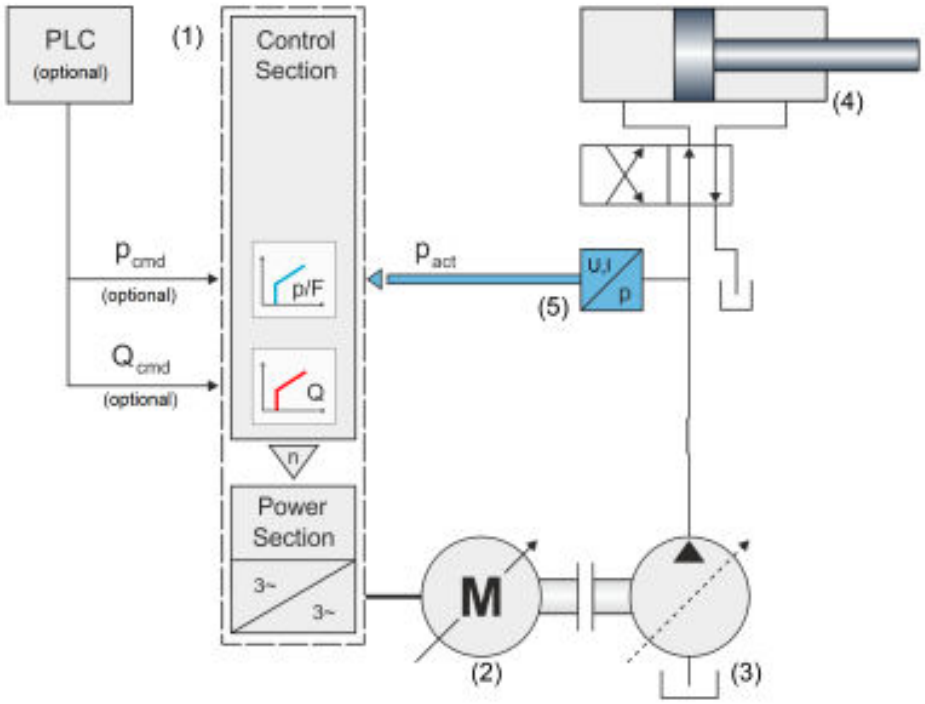


Fig. 1: SvP 7030 IMC system overview
(1) Drive controller ctrlX DRIVE
(2) Motor
(3) Pump
(4) Hydraulic system
(5) Pressure transducer (p_{act} = actual pressure value)

If you use a check valve, the lower speed limit has to be set to 0 rev/min.

Features of the product:

- Closed-loop pressure/flow control
  - Simple command value provision (internal command values)
  - Command value provision analogously or via bus communication
  - Digital filtering for rising and falling pressure command value

- Pressure signal feedback
  - Compatible with different types of pressure transducers (flexible weighting of the analog input signal for voltage and current sensors)
  - High immunity to electromagnetic interference (using the high-precision digital filter for signal filtering
  - Quick configuration of the Rexroth pressure transducer HM20
- Quick configuration of the Rexroth servo motor
- p/Q PID-control
  - p/Q control with automatic switching between pressure and flow control
  - With four switchable parameter sets
- Restoration of parameters of SvP 7030 IMC
- Extension functions
  - Master/slave operation
  - Pump power limitation
  - Leakage compensation
- Protective function
  - Error monitoring of pressure feedback
  - Actual pressure monitoring
  - Command value limitation of maximum pressure/flow
  - Command value limitation of minimum pressure/flow

For the description of the main functions, see functional description RE 62312-FK

5.3 Overview of components

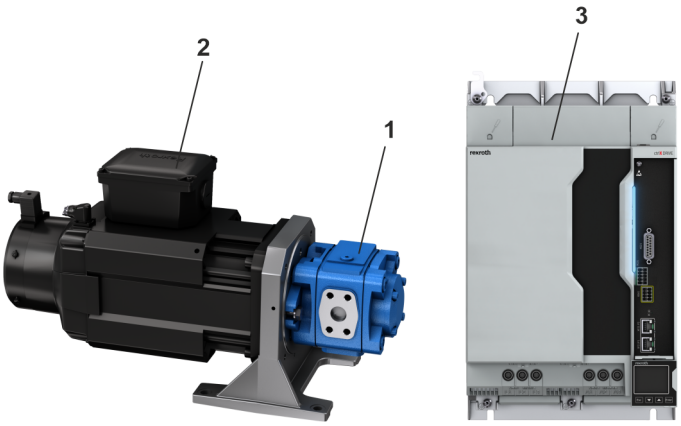
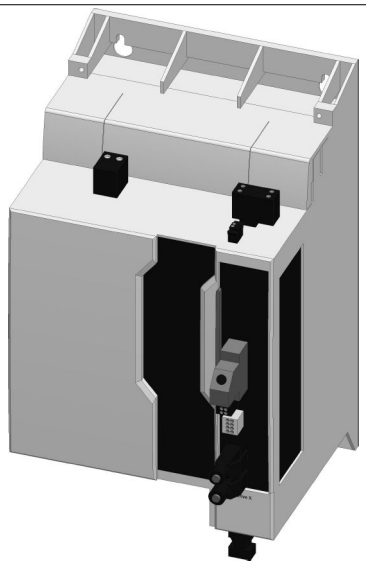


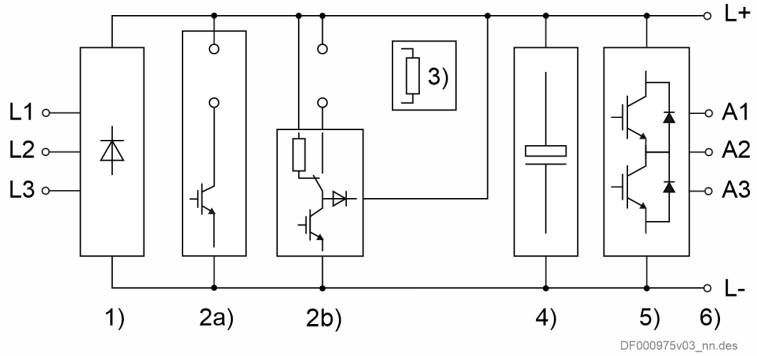
Fig. 2: SvP 7030 IMC system components

1 Pump (internal gear pump type PGH (see data sheet RE 10227) or PGM (see data sheet RE 20135) or axial piston pump type A10FZO (see data sheet RE 91485)
2 Synchronous servo motor (M2SN with self-cooling, external venting or water cooling) see Project Planning Manual R911347583)
3 Drive controller ctrlX DRIVE (see R911386579 Project Planning Manual)

5.3.1 Single-axis converter XCS



Single-axis converter



1) Mains input with rectifier
2a) Braking transistor (XCS ≥ W0100)
2b) Braking transistor/braking resistor (XCS ≤ W0070)
3) Optional external braking resistor
4) DC bus capacitors
5) Inverter stage with output to motor
6) DC bus connection

Table 4: XCS type code

Short type designation	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	40
Example:	X	C	S	2	-	W	0	1	0	0	A	B	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	S	V	P	S	0	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱			⑲	⑳	A	
①	**Product:** 1: **X** = ctrlX DRIVE 2: **C** C = Feeding converter 3: **S** = Single-axis 4: **2** = Generation 2; **1** = Generation 1;																																							
②	**Cooling type:** W = Air, internal																																							
③	**Maximum current:** 0100 = 100 A (example) Maximum currents: 23, 54, 70, 100, 120, 150, 180, 210, 250, 280																																							
④	**Degree of protection, input voltage:** A = IP20, 3 × AC 200 ... 500 V +10 % -15 %																																							
⑤	**Other power section options:** B = Braking transistor (XCS ≥ W0100) R = Integrated braking transistor/braking resistor (XCS ≤ W0070)																																							
⑥	**Connector set:** N = Without motor connector set																																							
⑦	**Control section:** 01 = ctrlX DRIVE 02 = ctrlX DRIVE^{plus}																																							
⑧	**Panel:** N = Without panel A = With panel																																							

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	X	C	S	2	-	W	0	1	0	0	A	B	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	3	R	S	N	1	S	V	P	S	0	N	N
	①					②	③				④	⑤	⑥		⑦		⑧	⑨		⑩		⑪		⑫			⑬	⑭		⑮		⑯	⑰	⑱				⑲	⑳	A	

⑨	**Communication:** ET = Multi-Ethernet with RJ45 X3 = ctrlX CORE
⑩	**Hardware option 1 - Safety:** T0 = Safe Torque Off (STO) M5 = SafeMotion (M5)
⑪	**Hardware option 2:** EC = Multi-encoder interface NN = Not equipped
⑫	**Hardware option 3:** NN = Not equipped ET = Multi-Ethernet DA = Digital/analog I/O extension
⑬	**Runtime type:** S = Standard
⑭	**Runtime version:** 03 = Version 03 (XCS2)
⑮	**Runtime release:** RS = Current release
⑯	**Export licenses required:** N = No (maximum output frequency < 599 Hz)
⑰	**Protocol - communication:** 0 = Defined via ctrlX CORE apps (XCS2) 1 = Sercos III 2 = EtherCAT (SoE) 4 = PROFINET IO
⑱	**Technology function** SvP = Servo-variable pump
⑲	**Scope of functions, Runtime:** N = DRIVE Runtime P = DRIVE Runtime Productivity S = DRIVE Runtime System Extension (required for SvP)
⑳	**Scope of functions, SafeMotion:** 0 = Hardware option 1 ≠ SafeMotion 3 = SafeMotion Speed 5 = SafeMotion Position
A	**Other design:** NN = None

5.3.2 Panel XDP1 (optional)

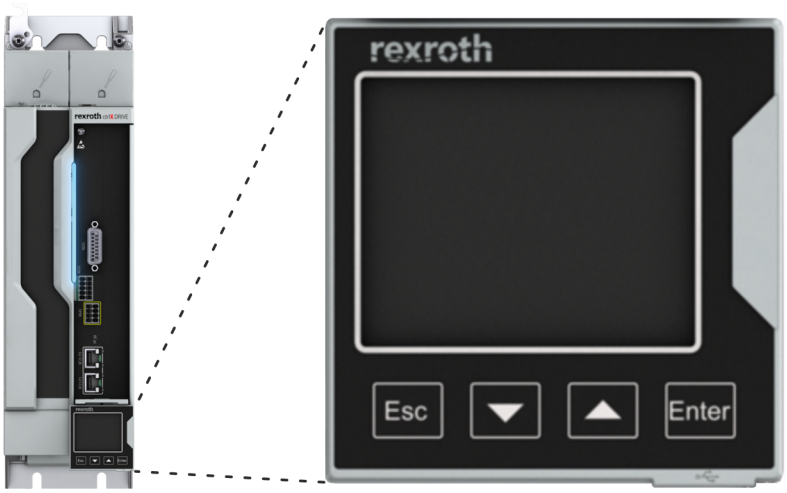


Fig. 3: Panel XDP1

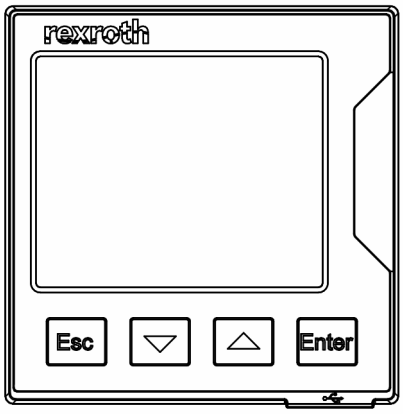
Table 5: Type code of panel

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	X	D	P	1	-	N	-	1	2	8	-	N	N	-	V	S	R	S	N	-	N	N																		
	①					②		③				④			⑤		⑥		⑦		⑧																				

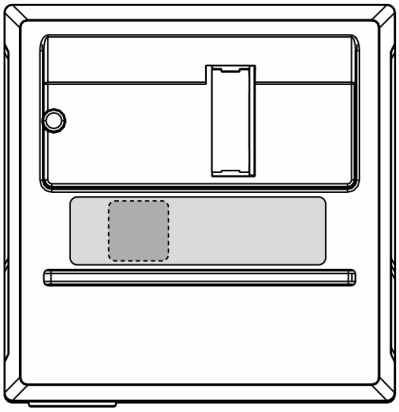
①	**Product:** XDP1 = Panel
②	**Wireless data carrier:** N = Without
③	**Internal memory:** 128 = 128 MB
④	**Other designs:** NN = None
⑤	**Panel firmware version:** VS = Current version
⑥	**Panel firmware release:** RS = Current release
⑦	**Export licenses required:** NN = no
⑧	**Other:** NN = None

Overview

Table 6: Panel

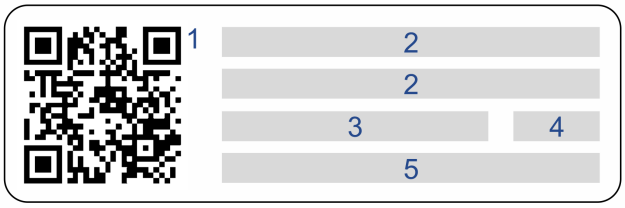
<table>
<tr><th colspan="3">Engineering tool for ctrlX DRIVE devices</th></tr>
<tr><td>Front</td><td> 
</td><td>

TFT display
4 keys: [Esc], [▼], [▲], [Enter]
Hot plug-compatible
Dynamic QR codes to display information at mobile end devices
USB C interface
Flash memory (128 MB, FAT)

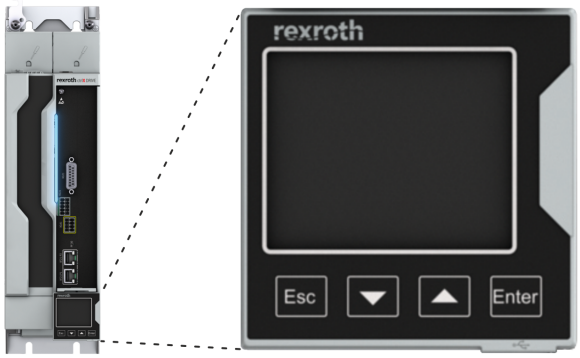
</td></tr>
<tr><td>Rear side</td><td> 
Nameplates:

10 × 10 mm:
Panel ordered as component of the device (CP-XDP1)
or
32 × 12 mm:
Panel ordered as individual component (XDP1-N-128-NN-VRSN-NN; R911403470)

</td><td> 

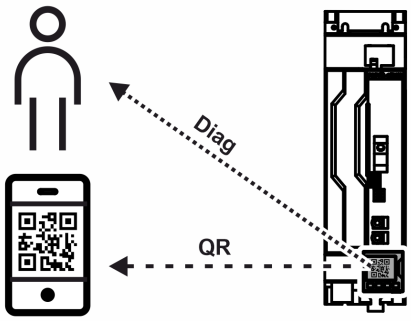
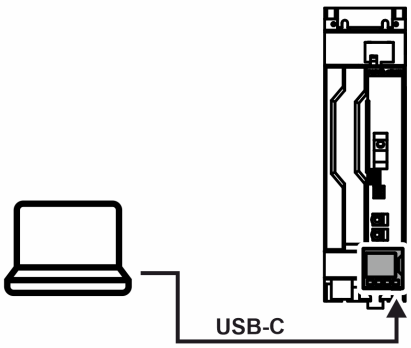
Nameplate (10 × 10 mm):
1: 2D code
2: Type
3: Hardware index
4: Production week (example: 20W38 means year 2020, week 38)
5: Material number
6: Serial number


Nameplate (32 × 12 mm):
1: QR code
2: Type
3: Material number
4: Hardware index
5: Serial number</td></tr>
</table>

Engineering tool for ctrlX DRIVE devices	
	Panel plugged on a ctrlX DRIVE device

Operation modes

Table 7: Operation modes

Operation mode		Description
Panel engineering		The panel is plugged on the ctrlX DRIVE device • Diagnostic display (at the panel and via QR code at mobile end devices) • Engineering tool for ctrlX DRIVE devices
USB engineering		The panel is plugged on the ctrlX DRIVE device and connected to a Windows PC via a USB cable.
USB storage medium		The panel is used as USB data carrier at a Windows PC (to save parameter sets, firmware downloads, diagnostic processes, etc.) • FAT file system • 128 MB

5.3.3 Motor-pump group MPA02

The motor pump group MPA02 consists of an MS2N servo motor and an internal gear pump or an axial piston pump. The two components are coupled directly, that is, the shaft of the pump is inserted in a toothed hollow shaft of the motor. This results in a particularly compact solution, which also offers advantages in terms of dynamics.

Further information on the motor pump group can be found in operating instructions R911387041.

5.3.4 Pressure transducer

Fig. 4: Pressure transducer HM20-2X

Further information on the pressure transducer can be found in data sheet RE 30272 and operating instructions 30272-B.

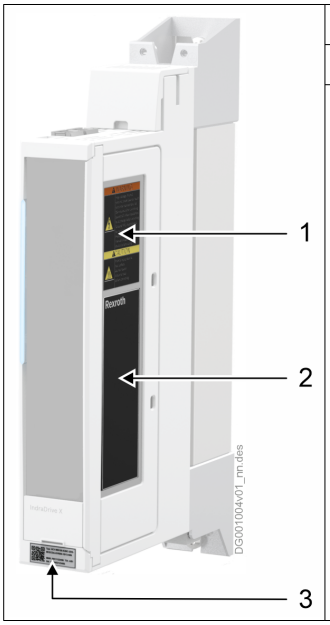
Please note that the analog input on the basic device cannot be configured for 4..20 mA. If you wish to use a pressure transducer for 4..20 mA, you require a DA extension.

5.4 Identification of the product

5.4.1 Plates on the drive controller

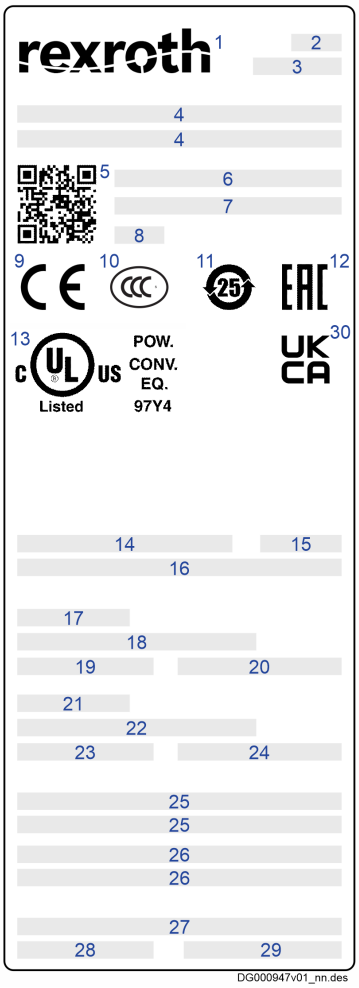
Positions of the plates

Table 8: Positions of the plates

	1	Warning labels
	2	Type plate
	3	Additional plate

Nameplate

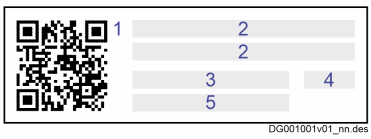
Table 9: Nameplate



1	Word mark/logo		20	Rated frequency Input frequency
2	Factory		21	Supply output data
3	Production week; 18W23, for example, means year 2018, week 23		22	Output voltage
4	Type designation		23	Output current
5	QR code		24	Output frequency
6	Material number		25	UL text
7	Serial number		26	UL text
8	Hardware index		27	Company address
9	CE conformity mark		28	Country of manufacture
10	CCC label		29	Service hotline
11	China RoHS 2		30	UKCA conformity mark
12	EAC conformity mark			
13	UL label			
14	Ambient temperature during operation			
15	Degree of protection provided by enclosure			
16	SCCR			
17	Supply input data			
18	Rated voltage Input voltage			
19	Rated current Input current			

Additional plate

Table 10: Additional plate



1	QR code
2	Type designation
3	Material number
4	Hardware index
5	Serial number

5.4.2 Nameplate of the motor pump group MPA02

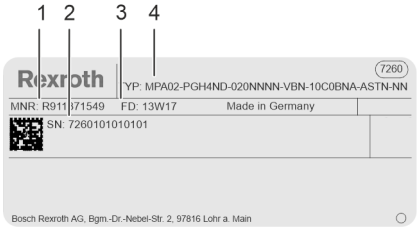


Fig. 5: Nameplate of MPA02
1 Material number
2 Serial number
3 Manufacturing date
4 Type designation

5.5 Acceptance tests and approvals

5.5.1 UL/CSA certification

The components haves been listed by **UL** (Underwriters Laboratories Inc.®).

Proof of certification can be found online. Enter the terms “UL” and “databases” in a search engine to get to the relevant UL web page. With the file number you will find the proof of certification.

Table 11: C-UL listing

c UL us **Listed** **POW. CONV. EQ.** **97Y4**	• UL standard: 61800-5-1 • CSA standard: Canadian Standard CSA C22.2 No. 274-17
	Company Name BOSCH REXROTH AG ➥ https://productiq.ulprospector.com/en/profile/3453329/nmms7.e134201?term=NMMS7&page=12 Category Name: • Power Conversion Equipment • Transformers, General Purpose - Component
	File numbers Components ctrlX DRIVE: • E134201 Additional components • E329212

UL ratings

When using the component in the scope of CSA / UL, observe the UL ratings for each component.

Make sure that the specified **short-circuit current rating SCCR** is not exceeded, e.g. by providing appropriate fuses in the mains connection of the supply unit.

UL wiring material

In the scope of CSA / UL, use copper only; class 1 or equivalent only with minimum allowed wire temperature of 75°C.

Allowed pollution degree

Comply with the allowed pollution degree of the components (see “Ambient and operating conditions”).

5.6 Customer testing

NOTICE	**Inadequate testing of the machine or system**
	Risk of damage!
	Before subjecting a system or machine, in which these components are used, to a voltage test or a test of insulation resistance:
	Disconnect all connections of the Rexroth components or unplug plug-in connections to protect electronic elements.

6 Transport and storage

6.1 Safety

⚠ WARNING	**Toppling over, falling or uncontrolled change in position of unsecured hydraulic components.** Unsecured Sytronix systems can topple over or fall down and, in the case of heavy weight, bruise or strike persons dead. – Observe the weight and the position of the center of gravity of the Sytronix system. Use only suitable lifting gear and, if required, industrial trucks for handling the Sytronix system. – Do not stand under suspended loads. Ensure that no unauthorized persons are within the danger zone. – For fixation and lifting of the product with lifting gear, only use the eyebolts and lifting attachments provided for this purpose. Observe the maximum load-bearing capacity of the attachment devices and industrial trucks. – Position the product on a suitable foundation. – Wear personal protective equipment. – Do not lift the motor and the pump at the shaft or at the optional fan housing. – Comply with the national laws and regulations regarding occupational health and safety for transporting/handling.
⚠ CAUTION	**Heavy loads!** Danger due to overload or not suited posture when lifting and transporting! – When carrying the product, apply suitable techniques for lifting, lowering and relocating or use suitable lifting gear. – Don’t transport the control system at sensitive attachments (e.g. sensors or valves). – Put the control system carefully on the supporting surface in order that it is not damaged.

6.2 Transporting the Sytronix system

The components of the Sytronix system shall be transported in their original packaging in compliance with classes 2K2, 2B1, 2C2, 2S2, 2M1 specified in DIN EN 60721-3-2.

Sytronix systems can be transported using a fork lift truck or lifting gear.

- Make sure that the load-carrying capacity of your fork lift truck or lifting gear is sufficient.

Drain the coolant from liquid-cooled motors before transport to prevent frost damage.

Please observe the following classification limitations:

- Transport temperature range -20 ... +80 °C
- Relative humidity of air max. 75 % (at +30 °C)
- No occurrence of salt mist
- Observe the transport instructions on the packaging.

- Always maintain the ambient conditions during storage and transport specified in the data sheets of the components (see table ➦ Chapter 1.2 “Required and supplementary documentation” on page 7).
- Use suitable shock absorbers if major shocks may occur during transport.
- Close the packaging according to the condition as supplied if it must be opened for checking reasons.
- If possible, do not remove the packaging until immediately before the assembly.

6.2.1 Handling the motor-pump unit with cranes or similar lifting gear

Transport with cranes and similar lifting gear may only be carried out using suitable slings such as lifting straps, belts and chains. At delivery, the motor-pump unit is provided with lifting points on the pump and on the motor, see the following table:

Table 12: Lifting points

Component	Lifting eye bolts DIN 580
MS2N10	2 x M8
MS2N13	2 x M10
PGH4-3X/	1 x M8
PGH5-3X/	1 x M10
PGM4-4X/	1 x M8

For detailed information about the carrying capacity of the ring screws, refer to standard DIN 580.

- For lifting, use the provided positions or lifting points.
- Always fasten the lifting means at 2 lifting points at the motor-pump unit. Never lift the motor-pump unit at one lifting point only.
- Slowly and carefully lift and lower the motor-pump unit.

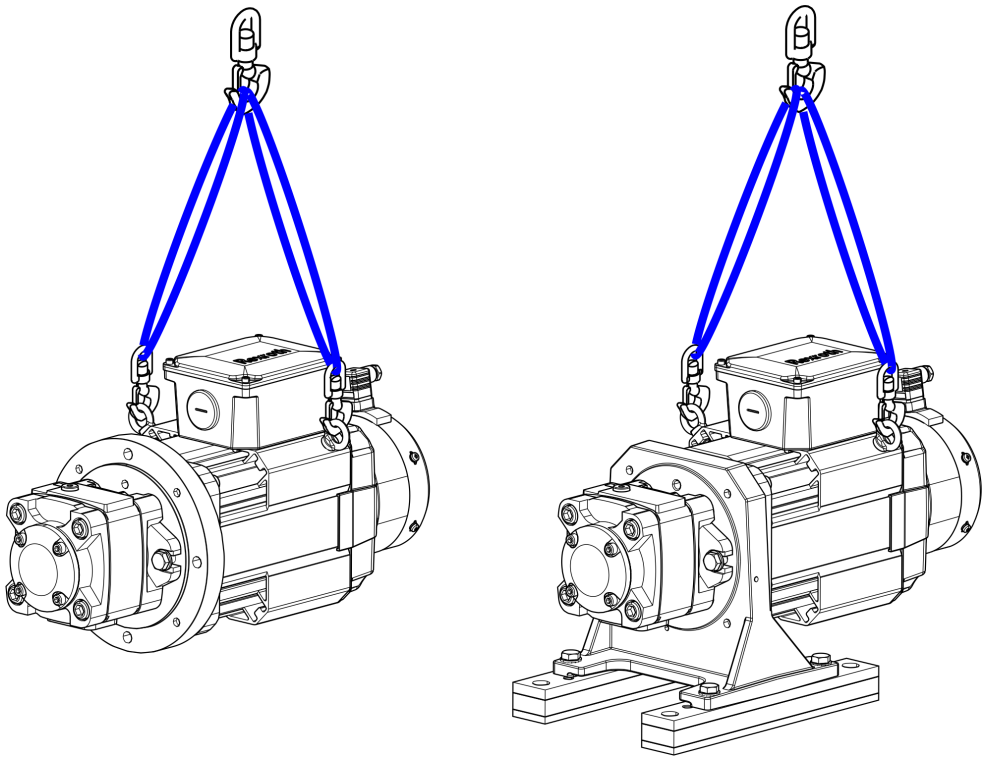


Fig. 6: Handling MPA02

6.2.2 Weight of motor-pump units

Table 13: Weight of internal gear pump

Pump type	PGH4						PGH5				
Size	20	25	32	40	50	63	63	80	100	125	160
Weight kg	14	14.5	15	16	17	18	42	43.5	45.5	48	52

Pump type	PGM4				
Size	25	32	40	50	63
Weight	12	12.5	13.5	14	14.5

Table 14: Weight of axial piston pump A10FZO

Size	3	6	8	10	18	28	45	63
Weight kg	9	9	9	9	10	15.5	21	26

Table 15: Weight of MS2N10 motors

Cooling type	Self-cooling				External ventilation				Liquid cooling			
Overall length	C	D	E	F	C	D	E	F	C	D	E	F
Weight kg	23.5	34.0	45.0	55.0	24.5	35.0	46.0	56.0	29.0	39.0	49.0	59.0

Table 16: Weight of MS2N13 motors

Cooling type	External ventilation MS2N13-...			Water cooling MS2N13-...		
Motor type	... C1BHC	...D1BHC	...E1BHC	...C1BHL	...D1BHL	...E1BHL
Weight kg	108	127	146	102	121	146

Table 17: Weight of mounting components for MPA02 (with MS2N10 motors)

	Adapter flange	Pump foot	Damping bars	
			Short (SN)	Long (DN)
Weight kg	2.8	13.6	5.0	7.0

Table 18: Weight of mounting components for MPA02 (with MS2N13 motors)

	Adapter flange	Pump foot	Damping bars	
			Short (SN)	Long (DN)
Weight kg	15.7	17	5.8	8.9

The indicated weights only apply to the single components; for weights of motor-pump combinations, the individual values must be added up.

For motor-pump groups with conventional coupling and pump mounting bracket, the weights of these coupling elements can be found in the data sheet of the manufacturer

6.2.3 Ambient conditions for transporting

Table 19: Ambient and operating conditions - transport

Designation	Symbol	Unit	Value
Temperature range	T_{a_tran}	°C	-25 ... +70
Relative humidity		%	5 ... 95
Absolute humidity		g/m³	1 ... 60
Climatic category (IEC721)			2K3
Moisture condensation			Not permitted
Icing			Not permitted

6.3 Storing Sytronix systems

NOTICE

Risk of damage to components from long-term storage!

Some components contain electrolytic capacitors which may deteriorate during storage.

When storing the following components for a longer period of time, run them once a year for at least 1 hour: :

- Converters and supply units: Operation with mains voltage U_{LN}
- Inverters and DC bus capacitor units: Operation with DC bus voltage U_{DC}

NOTICE

Wet and humidity!

Risk of damage!

- Protect the products against moisture with covers.
- Store the products exclusively in moisture-proof, dry rooms.

6.3.1 Storage conditions

Table 20: Storage conditions for components to be installed in control cabinets

Designation	Symbol	Unit	Value
Temperature range	T_{a_store}	°C	-25 ... +55
Relative humidity		%	5 ... 95
Absolute humidity		g/m³	1 ... 29
Climatic category (IEC721)			1K3
Moisture condensation			Not permitted
Icing			Not permitted
Salt mist			Not permitted

Store the products in their original packages in a dry, dust-free, vibration-free place, and protect them from light and direct solar radiation. Comply with the classes 1K2, 1B1, 1C1, 1S1, 1M2 specified for storage acc. to DIN EN 60721-3-2.

Table 21: Storage conditions for MPA02

Designation	Symbol	Unit	Value
Temperature range	T_{a_store}	°C	-20 ... +60
Relative humidity		%	5 ... 95
Absolute humidity		g/m³	1 ... 29
Moisture condensation			Not permitted
Icing			Not permitted
Salt mist			Not permitted

6.3.2 Storage times

Additional measures must be taken on commissioning to preserve proper functioning – irrespective of the storage time which may be longer than the warranty period of our products. However, this does not involve any additional warranty claims.

Motors

Table 22: Measures before commissioning motors that have been stored over a prolonged period of time

Storage time / months			Measures for commissioning
> 1	> 12	> 60	
•	•	•	Check all parts for freedom from damage.
	•	•	Check all electrical contacts for corrosion.
	•	•	Let the motor bearings run in without load for one hour at 800 ... 1000 rpm. When the pump is mounted, make sure that the pump does not run dry.
	•	•	Measure the insulation resistance. For values < 1 kOhm per volt rated voltage, the winding must be dried.
		•	Replace the bearing.
		•	Replace the encoder.

Cables and connectors

Table 23: Measures before commissioning cables and connectors that have been stored over a prolonged period of time

Storage time / months			Measures for commissioning
> 1	> 12	> 60	
•	•	•	Check all parts for freedom from damage.
	•	•	Check all electrical contacts for corrosion.
		•	Visual inspection of the cable jacket. Do not use the cable if you detect any abnormalities (squeezed or kinked spots, discoloration, ...).

Internal gear or axial piston pumps

Table 24: Measures to be taken before commissioning pumps with long-term storage

Storage time / months			Measures for commissioning
> 1	> 12	> 60	
•	•	•	Leave the internal pump as delivered (wetted with mineral oil).
	•	•	Fill the pump with mineral oil
	•	•	Inspect the complete pump for damage and corrosion before installing it. Check the pump for proper function and leaks during a test run. Replace the shaft seal if a storage period of 24 months is exceeded. As a precaution, we recommend that you have the pump checked and the seals replaced by a Rexroth service after the maximum storage period has expired!

7 Installation

Before starting to install the system, you should have the following documents at hand:

7.1 General information

⚠ CAUTION	**Insufficient space!** Risk of bumping or bruising when components, operating and display elements are unfavorably arranged. – Provide for sufficient installation space. – Observe the installation instructions. – Wear personal protective equipment.

⚠ CAUTION	**Removed protective plugs!** Risk of falling or slipping due to draining test oil. – Only remove protective caps directly before connecting the ports.

This chapter describes the assembly and installation of the Sytronix system SvP 7030 IMC at the place of use as well as the connection to the hydraulic system and to the electrical system of the machine. Details on the installation in the machine and in particular on the overall functionality and operating logic can be found in the instructions and/or documentation for the complete machine.

These installation instructions are tailored to the use of the Sytronix system SvP 7030 IMC. Observing these instructions is a decisive factor for the service life of the units.

The instructions refer to standard types and standard installation conditions. Special installation situations require special, additional measures to be taken on the unit.

7.2 Unpacking

⚠ CAUTION	**Parts falling out!** If the packaging is not opened correctly, parts may fall out and cause injury. – Put the packaging on level, bearing ground. – Only open the packaging from the top.

- Dispose of the protective foils and packaging material in accordance with the national regulations of your country.

7.3 Mechanical installation of the motor-pump unit

7.3.1 Installation conditions

- Adhere to the limits specified for temperature, viscosity, cleanliness of the hydraulic fluid, etc. in the data sheets and in the chapter “Transport and storage” above.
- Make sure that the housing of the pump is filled with hydraulic fluid. This must also be observed during longer periods of standstill, because the Sytronix system may drain via the hydraulic lines.
- To achieve favorable noise values, decouple all connecting lines from all components that can vibrate (e.g. tank) using elastic elements.
- Make certain that the suction line, case drain line, and return line flow into the tank below the minimum fluid level in all operational states.

- Strictly observe utmost cleanliness. The Sytronix system must be installed without any contamination. Contamination of the hydraulic fluid can significantly affect the service life of the Sytronix system.
- Do not use cotton waste or linty cloths for cleaning.
- Use suitable liquid cleaning agents to remove lubricants and other difficult-to-remove dirt. Cleaning agents must not penetrate the hydraulic system.

7.3.2 Compatibility with foreign substances

All drives and controls from Bosch Rexroth are developed and manufactured according to the state of the art.

However, since it is impossible to pursue the continuing further development of all substances with which the drives and controls may get into contact (e.g. lubricants in machine tools), reactions with the materials used by us cannot be ruled out in any case.

For this reason you have to carry out a compatibility test with new lubricants, cleaning agents, etc. and our housings/materials.

7.3.3 Installation position and orientation of the motor-pump unit

The installation orientation (orientation of the pump/motor shaft end vertical, horizontal, etc.) and the installation position (pump/motor in relation to tank) of the Sytronix system essentially determine the procedures during installation and commissioning (such as for filling the axial piston unit).

Note that you can expect certain installation positions to affect the control behavior or the adjustment feature. Because of gravity, dead weight and case pressure, minor characteristic curve offsets and changes in actuating time may occur.

A detailed description of the installation and mounting conditions as well as the installation of the motor-pump unit can be found in the operating instructions for MPA02, R911387041.

Special attention has to be paid to the connection and wiring of the motor power cable, of the encoder and the cooling fan.

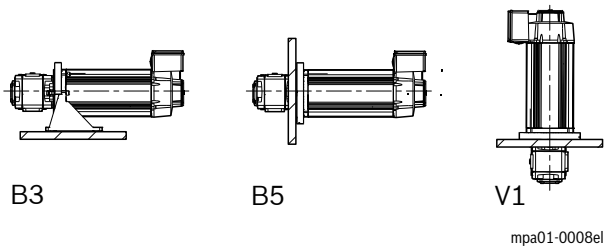


Fig. 7: Installation orientations

The motor-pump group can be foot- or flange-mounted. Permissible installation orientations according to EN 60037-7 IM B3, IM B5 and IM V1. A vertical installation orientation IM V3 (motor under pump) is not permitted.

7.3.4 Connecting SvP 7030 hydraulically

NOTICE

Hydraulic pipes and hoses installed under stress!

Hydraulic pipes and flexible hoses which are installed under mechanical stress generate additional mechanical forces during operation, which reduces the service life of the Sytronix system and the machine or system as a whole.

- Install pipes and flexible hoses stress-relieved.

NOTICE

Insufficient suction pressure!

Risk of damage! Generally, a minimum permissible suction pressure at port “S” is prescribed for Sytronix systems in all installation orientations. The permissible minimum suction pressure can be found in the data sheet of the pump. If the pressure at port “S” drops below the specified values, damage may occur which may lead to the destruction of the Sytronix system.

- Make sure that the required suction pressure is achieved. This is influenced by:
  - appropriate piping of the suction cross-sections
  - appropriate pipe diameters
  - appropriate position of the tank
  - suitable viscosity of the hydraulic fluid

The machine or system manufacturer is responsible for dimensioning the lines. The Sytronix system must be connected to the rest of the hydraulic system in accordance with the hydraulic circuit diagram of the machine or system manufacturer.

Notes on the routing of lines and the optimum installation

Please observe the following notes on the routing of suction, pressure and case drain lines:

- See to it that the suction line (pipe or flexible hose) is as short and straight as possible.
- The line cross-section of the suction line is to be dimensioned so that the pressure in the suction port does not fall below the minimum permissible value and the maximum permissible pressure is not exceeded.
- Observe air tightness of the junctions and pressure resistance of the flexible hose, also with respect to the atmospheric pressure.
- In conjunction with the pressure lines, make certain that the pipes, flexible hoses and connecting elements are approved for the operating pressure range.
- Always route case drain lines so that the housing is constantly filled with hydraulic fluid and ensure that no air gets through the shaft seal ring even during extended standstill periods. Under no operating conditions may the pressure inside the case exceed the limit values specified for the Sytronix system. The case drain line in the tank must in any case terminate below the minimum fluid level.

The ports and mounting threads are rated for the operating pressures specified in the data sheet. The machine or system manufacturer must ensure that the connecting elements and lines comply with the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

Piping conditions

Improperly installed suction line in the tank

Poor aspiration conditions may lead to abnormal noise as well as excessive wear due to cavitation.

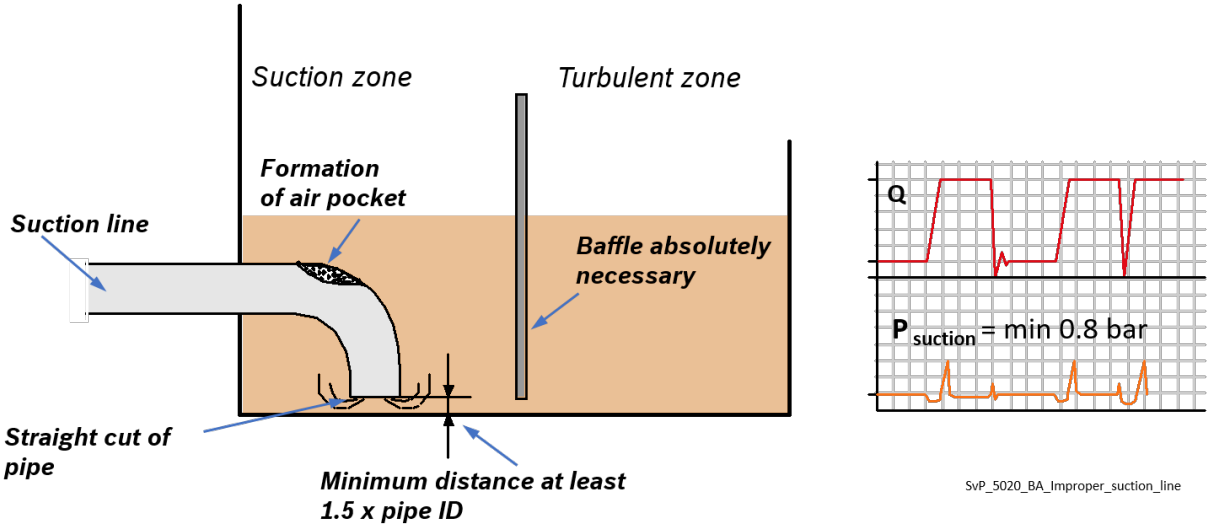


Fig. 8: Improperly installed suction line

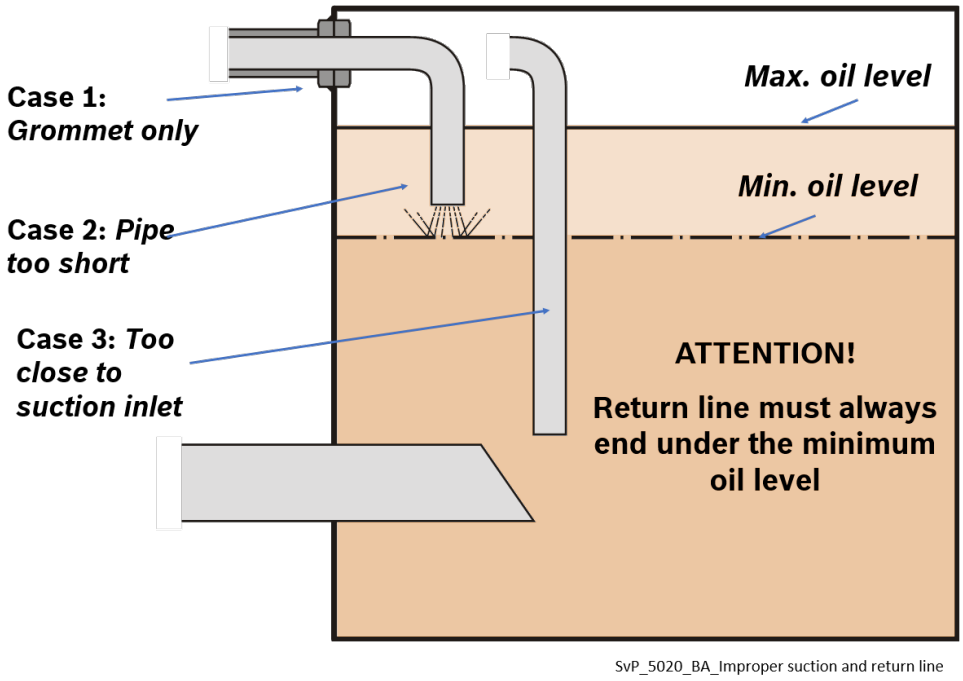


Fig. 9: Improperly laid suction and return line

To minimize risk due to air pockets you should do without long, horizontally installed suction lines.

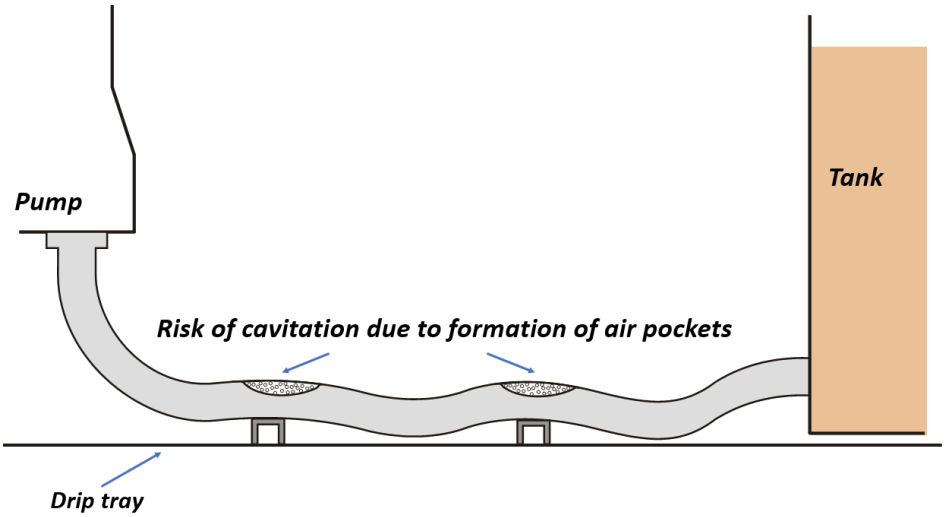


Fig. 10: Risk due to air pockets

Moreover, improperly installed suction lines can be a cause of noise generation.

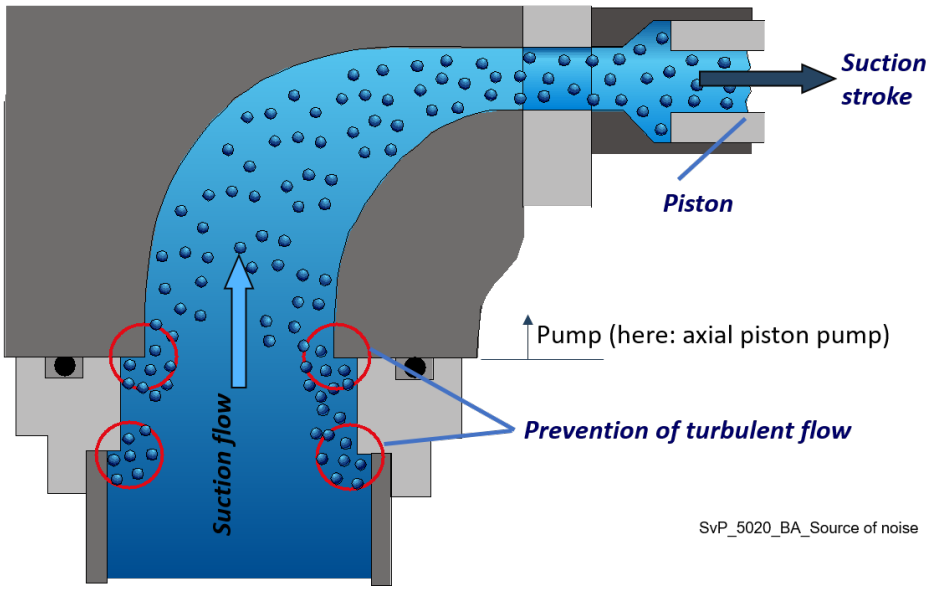


Fig. 11: Noise sources

A further important point is the proper connection.

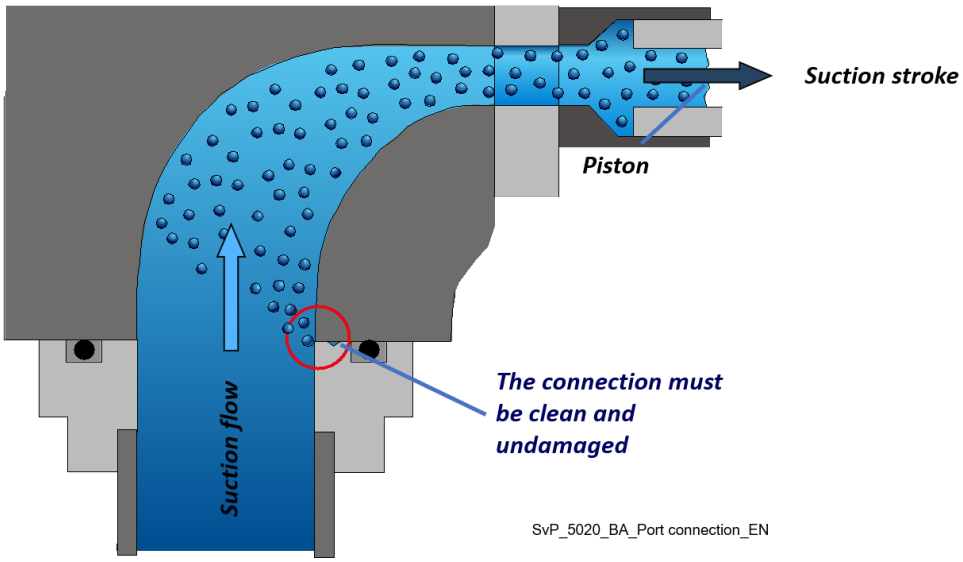


Fig. 12: Connection
Missing O-rings can lead to air ingress.

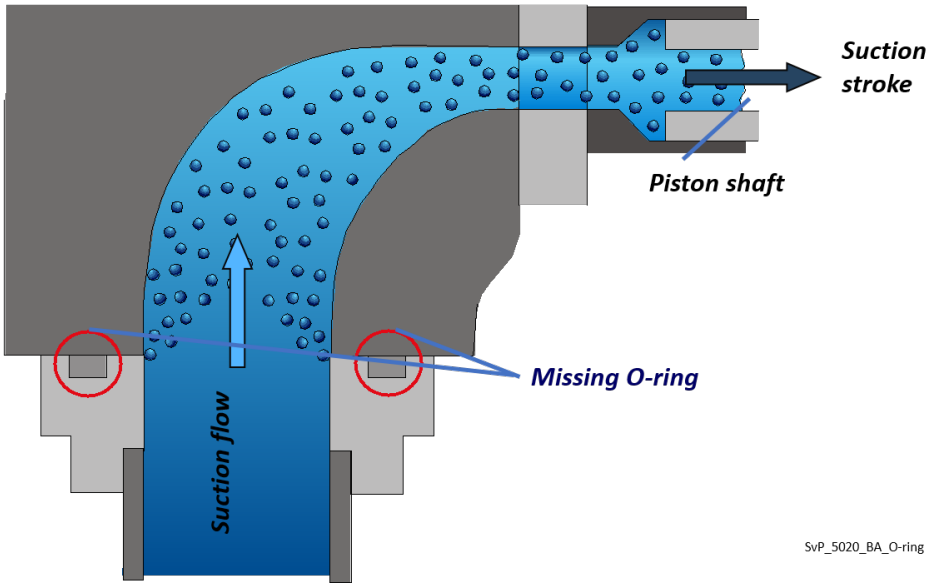


Fig. 13: Assembly without O-rings

Notes for a good suction line design

Keep the following distance for mounting the suction line in the tank.

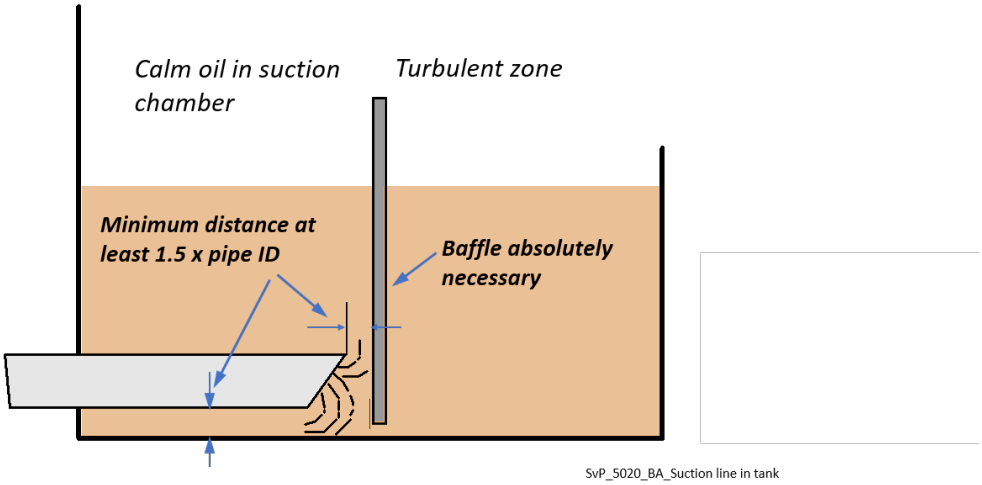


Fig. 14: Suction line in the tank

The following figure shows an optimum connection in detail:

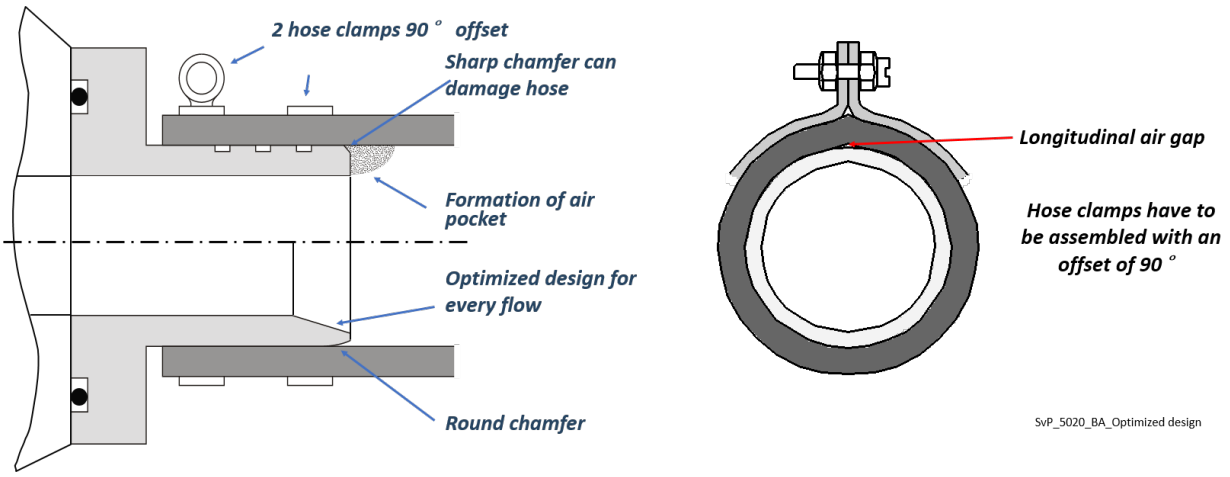


Fig. 15: Optimized design

The following figure illustrates the perfect condition for the laminar flow

Piping

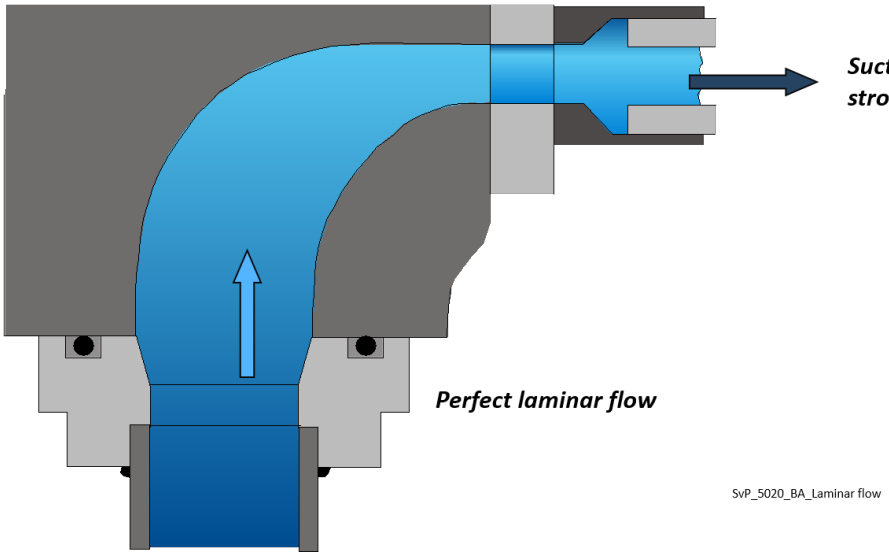


Fig. 16: Laminar flow

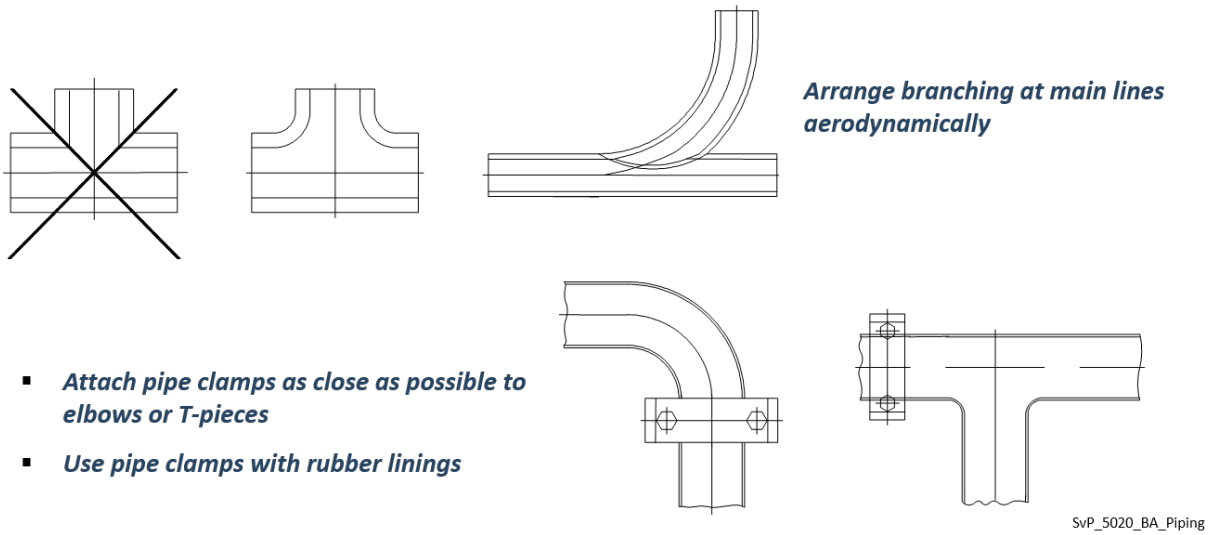


Fig. 17: Piping notes

Noise reduction

Flexible mounting reduces vibration and noise.

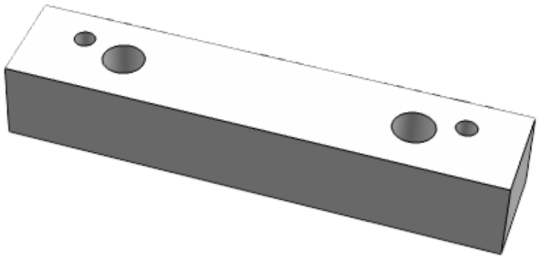


Fig. 18: Damping rail

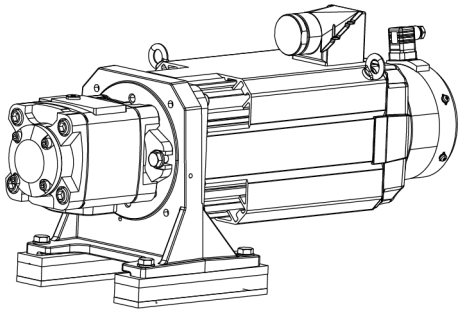


Fig. 19: Damping rail in the mounted condition

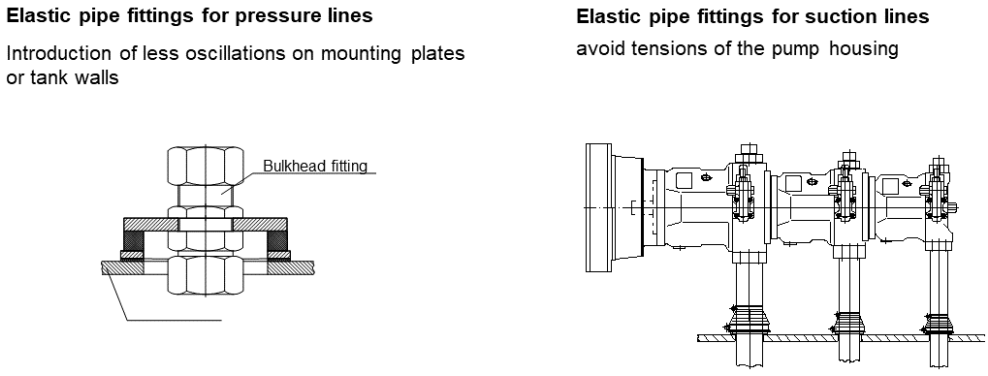


Fig. 20: Elastic pipe fittings

Optimum oil condition

Optimum oil condition on the surface and below

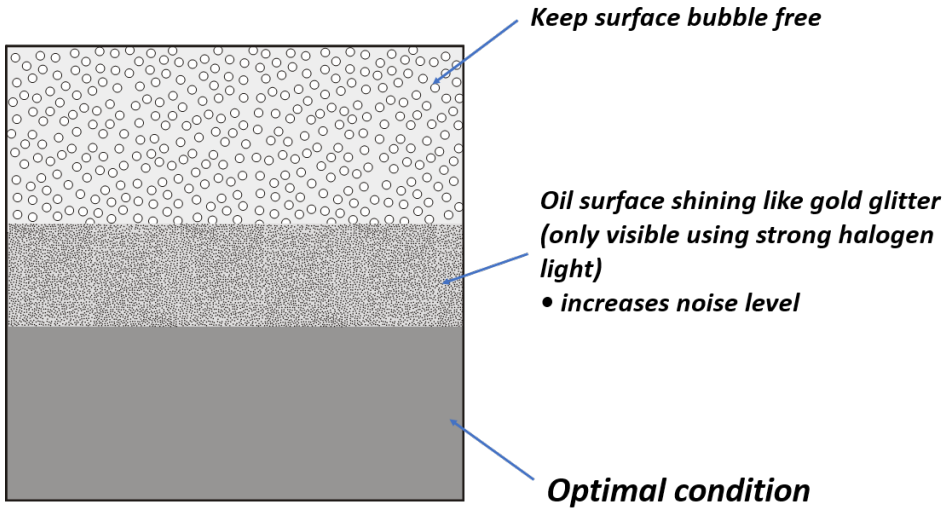


Fig. 21: Optimum oil condition

Connecting

To connect the Sytronix system to the hydraulic system:

1. Remove the plug screws from the ports that are to be connected according to the hydraulic circuit diagram.
2. Use only clean hydraulic lines.
3. Connect the lines according to the hydraulic circuit diagram.

   Either pipes or flexible hoses must be connected to all ports according to the installation drawing and machine or system circuit diagram or the ports have to be plugged using suitable plug screws.

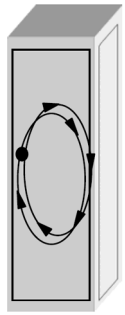
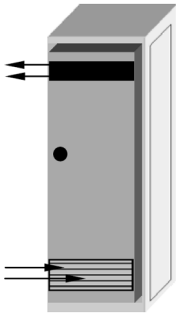
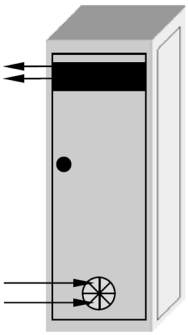
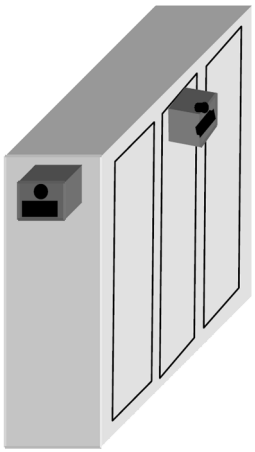
   ℹ The installation drawing contains the dimensions of all connections and ports on the Sytronix system. Also observe the instructions provided by the manufacturers of the other hydraulic components when selecting the required tools.:
4. Make sure that
   - the cap nuts are correctly tightened on the fittings and flanges (observe tightening torques!). Mark all checked fittings using e.g. a permanent marker.
   - pipes and flexible hoses and every combination of connecting pieces, couplings or connecting points with flexible hoses or pipes have been inspected by a technically qualified person for their safe working condition.

7.4 Mounting the machine control cabinet components

7.4.1 Control cabinet design and cooling

G1 is the only mounting orientation allowed for supply units and drive controllers installed in control cabinets.

Table 25: Possibilities of heat dissipation

Closed control cabinet with air circulation	Closed control cabinet with heat exchanger	Control cabinet with fan	Closed control cabinet with air conditioning unit
 DF000644	 DF000645	 DF000646	 DF000647

In the following, the case “control cabinet with fan” is described.

Requirements for control cabinets with fan

NOTICE

Impure air in the control cabinet

Risk of damage!

If you operate a control cabinet with fan without the required filters, devices may be damaged or malfunction can occur.

- Install filters at the air inlets of the control cabinet to prevent impure air from entering the control cabinet.
- Maintain the filters regularly in accordance with the dust load in the surroundings.
- Change the filters only while the fan is switched off, since otherwise the dissolving dirt is aspired by the fan and gets inside the control cabinet.

Venting of the control cabinet (basic principle)

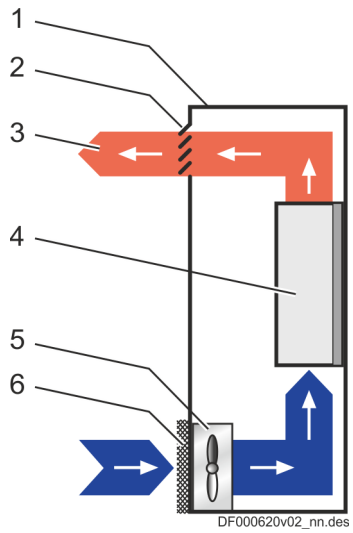


Fig. 22: Venting of the control cabinet (basic principle)
1 Control cabinet
2 Air outlet
3 Heat dissipation
4 Device in the control cabinet
5 Control cabinet fan
6 Filter at the air inlet

Thanks to the filter at the air inlets only clean air gets into the control cabinet. The control cabinet fan behind the air inlet transports air into the control cabinet and generates overpressure in the control cabinet. The overpressure prevents impure air from entering the control cabinet through, for example, any leaky spots (leaky cable glands, damaged seals, ...).

Mounting orientations of components

NOTICE

Wrong installation orientation

Risk of damage to the components!

Only operate the components in their allowed installation orientation.

Allowed mounting orientation of the components

Only the mounting orientation **G1** is allowed for ctrlX DRIVE components.

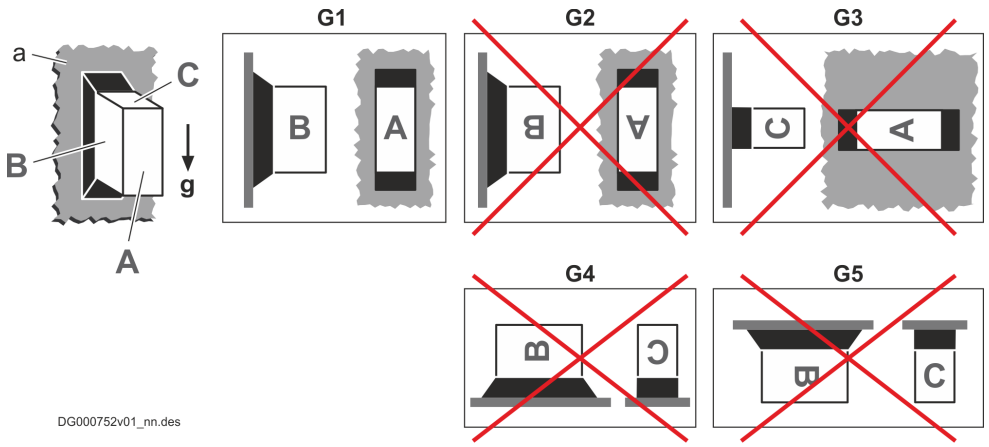
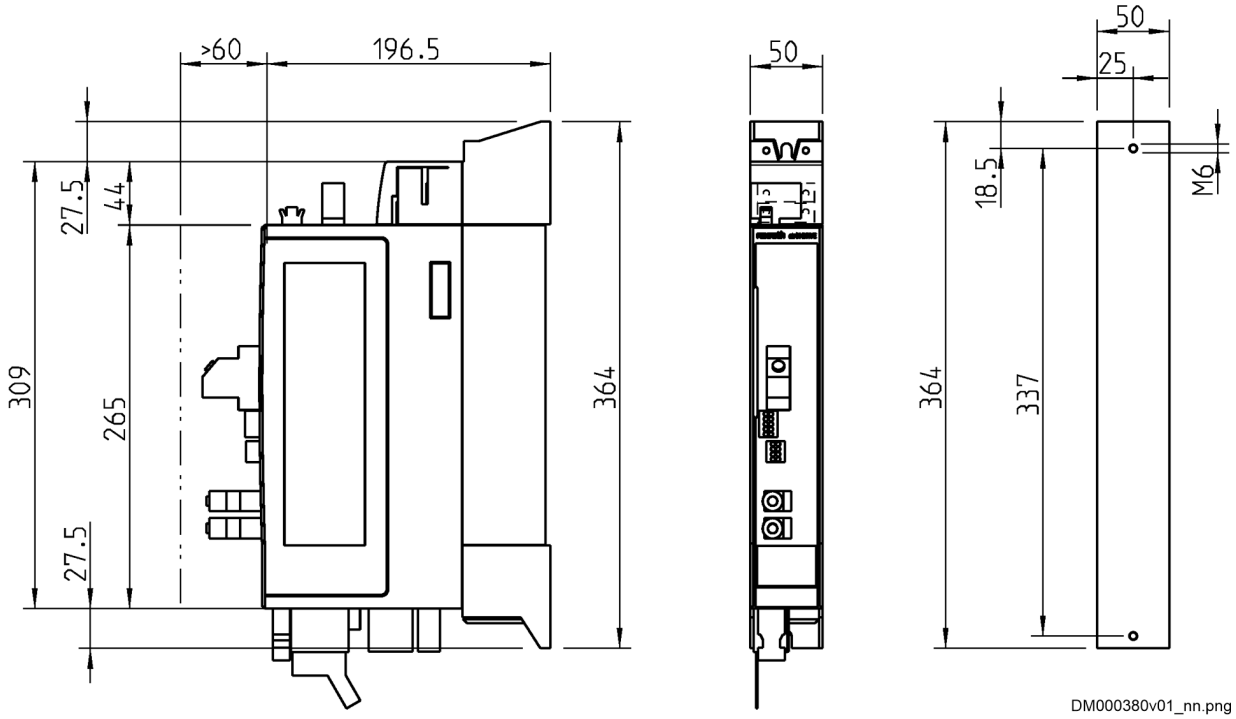


Fig. 23: Allowed mounting orientation of the components

A, B, C Sides of a component: A = front side, B = left or right side, C = top side
a Mounting surface in control cabinet
g Direction of gravitational force
G1 **Normal mounting position:** The natural convection supports the forced cooling air current. This avoids the generation of pockets of heat in the component.
G2 180° to normal mounting orientation
G3 90° to normal mounting orientation
G4 Bottom mounting; mounting surface on bottom of control cabinet
G5 Top mounting; mounting surface at top of control cabinet

7.4.2 Single-axis converter XCS*-W0023

Dimensional drawing



Dimensions, weight, insulation

Table 26: Data for weight, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0023
Weight	m	kg	tbd
Device height[1)]	H	mm	309
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	50
Insulation resistance at 500 V DC	R_{is}	MOhm	1
Capacitance against housing	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 27: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0023
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Reduction of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting orientation			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	36
Allowed switching frequencies[1)]	f_s	kHz	4 ... 16

Designation	Symbol	Unit	XCS*-W0023
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	93
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Lateral minimum distance at the device[3)]	d_{hor}	mm	0 (for devices in the DC bus group) 10 (for devices outside of the DC bus group)

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

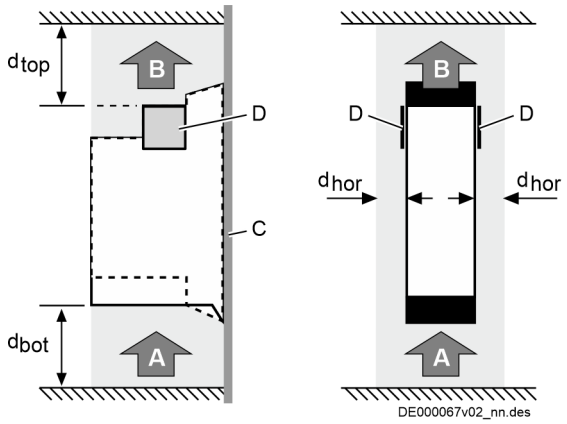
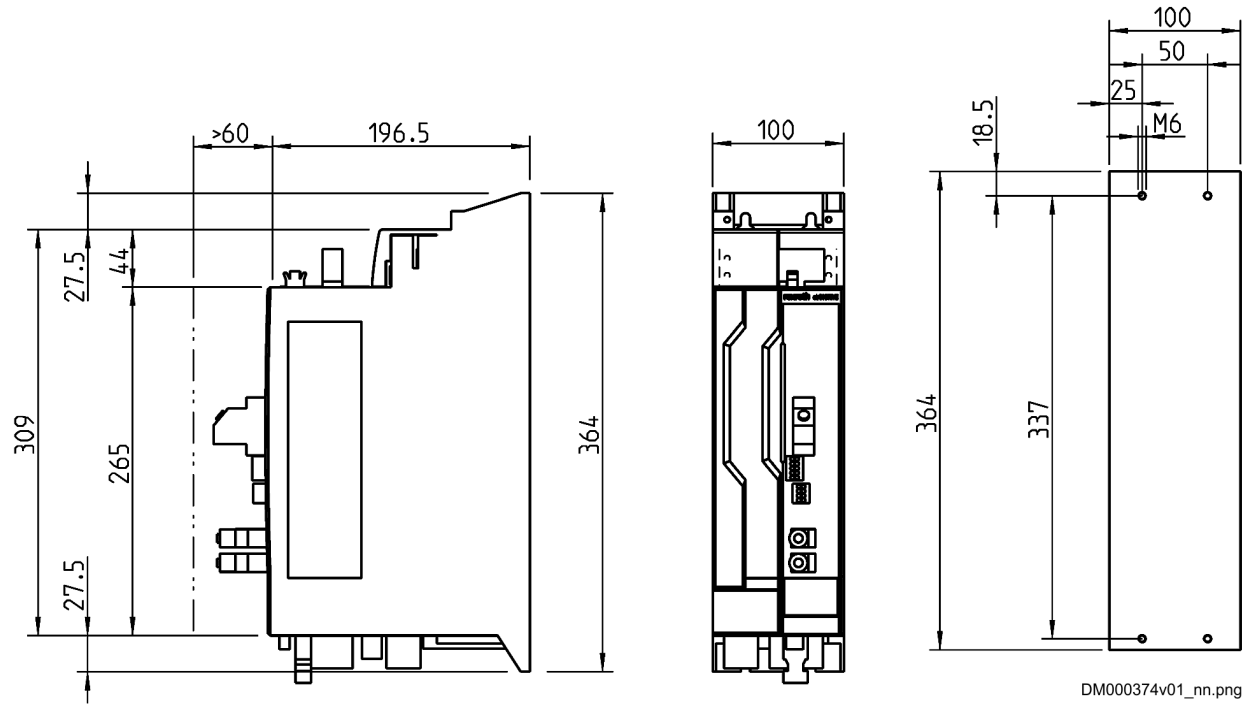


Fig. 24: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

7.4.3 Single-axis converter XCS*-W0054

Dimensional drawing



Dimensions, weight, insulation

Table 28: Data for weight, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0054
Weight	m	kg	5.8
Device height[1)]	H	mm	309
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	100
Insulation resistance at 500 V DC	R_{is}	MOhm	1
Capacitance against housing	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 29: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0054
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Reduction of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed installation orientation			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	89
Allowed switching frequencies[1)]	f_s	kHz	4 ... 16
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	286
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Lateral minimum distance at the device[3)]	d_{hor}	mm	0 (for devices in the DC bus group) 10 (for devices outside of the DC bus group)

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

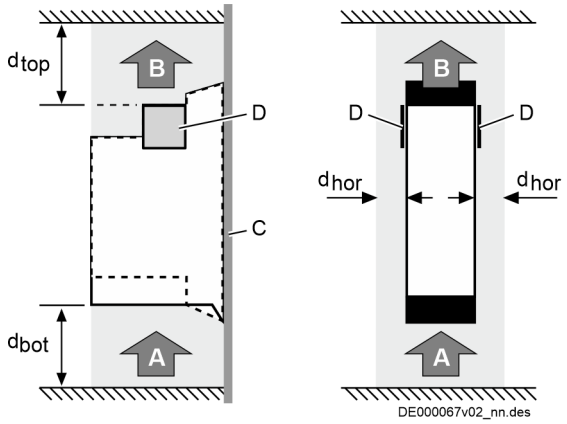
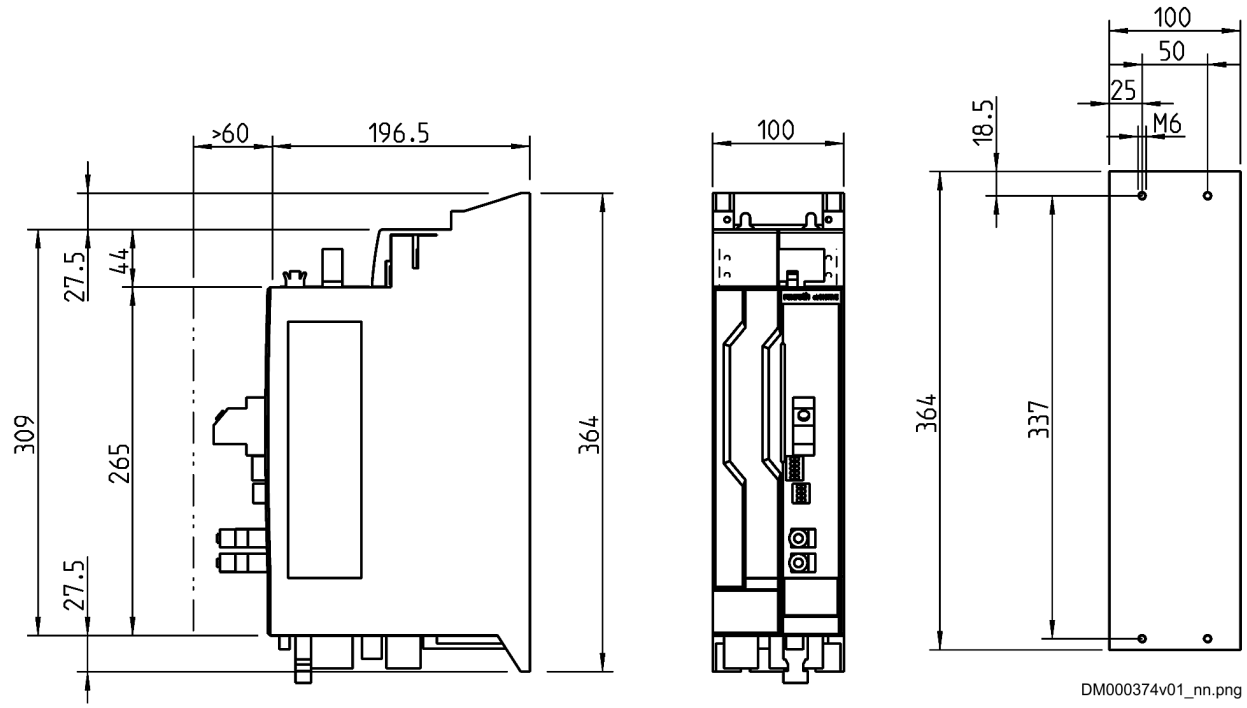


Fig. 25: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

7.4.4 Single-axis converter XCS*-W0070

Dimensional drawing



Dimensions, weight, insulation

Table 30: Data for weight, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0070
Weight	m	kg	5.8
Device height[1)]	H	mm	309
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	100
Insulation resistance at 500 V DC	R_{is}	MOhm	1
Capacitance against housing	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 31: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0070
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Reduction of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting orientation			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	144
Allowed switching frequencies[1)]	f_s	kHz	4 ... 16
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	406
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Lateral minimum distance at the device[3)]	d_{hor}	mm	0 (for devices in the DC bus group) 10 (for devices outside of the DC bus group)

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

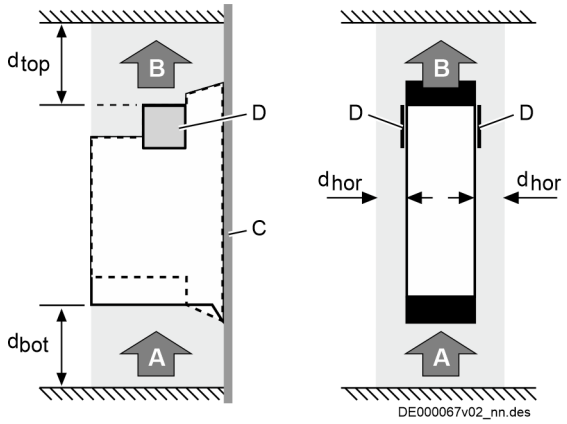
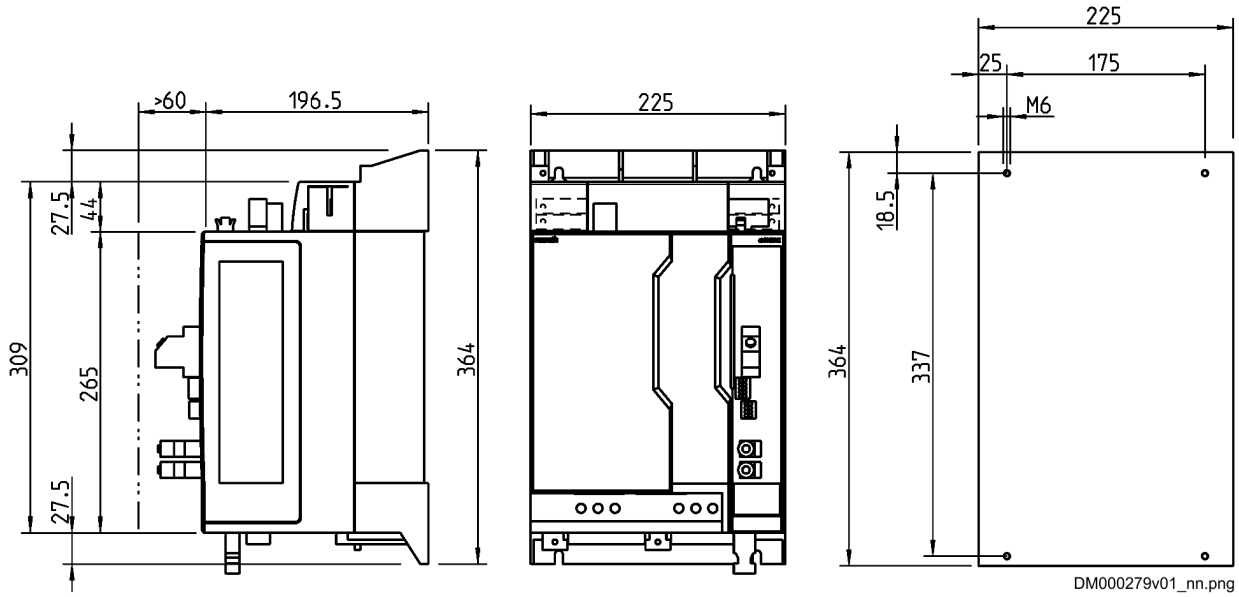


Fig. 26: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

7.4.5 Single-axis converter XCS*-W0100

Dimensional drawing



Dimensions, weight, insulation

Table 32: Data for weight, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0100
Weight	m	kg	10.3
Device height[1)]	H	mm	309
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	225
Insulation resistance at 500 V DC	R_{is}	MOhm	1
Capacitance against housing	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 33: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0100
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Reduction of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting orientation			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	178
Allowed switching frequencies[1)]	f_s	kHz	4 ... 16
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	736
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Lateral minimum distance at the device[3)]	d_{hor}	mm	0 (for devices in the DC bus group) 10 (for devices outside of the DC bus group)

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

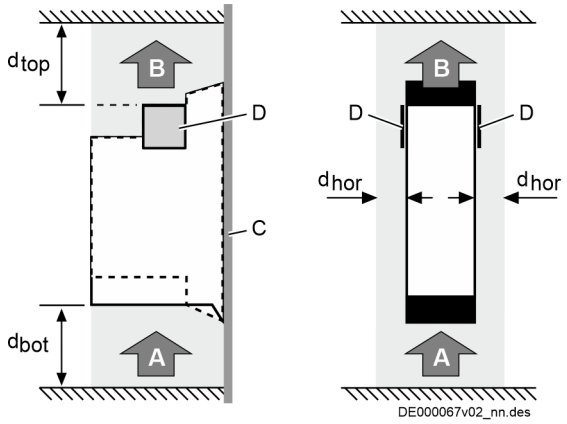
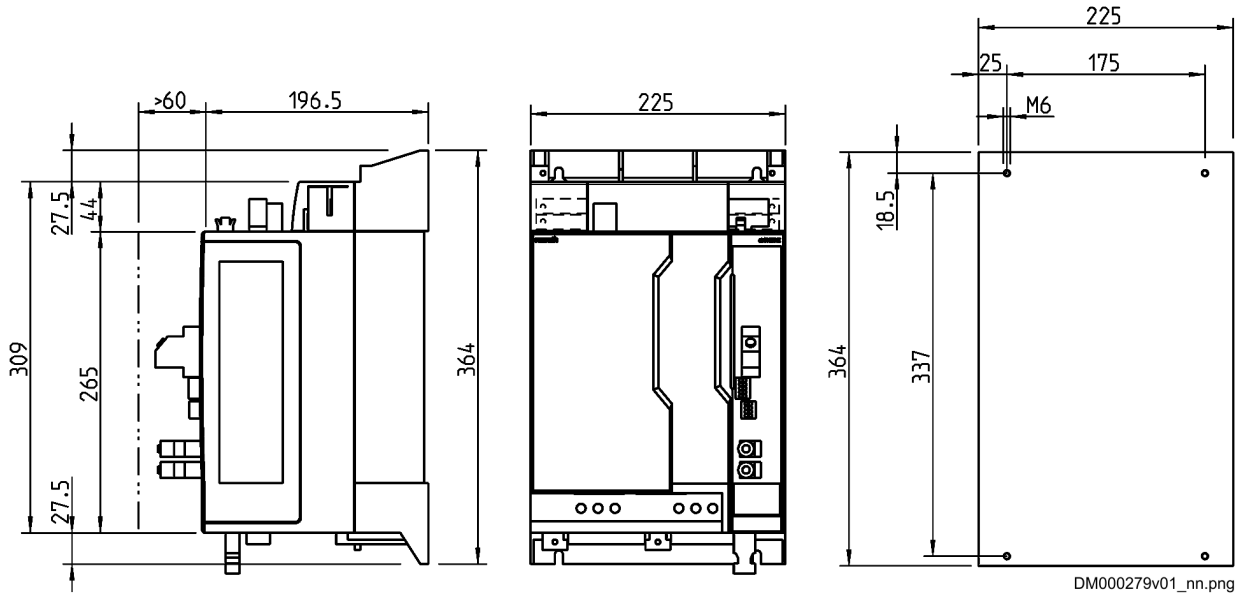


Fig. 27: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

7.4.6 Single-axis converter XCS*-W0120

Dimensional drawing



Dimensions, weight, insulation

Table 34: Data for weight, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0120
Weight	m	kg	10.3
Device height[1)]	H	mm	309
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	225
Insulation resistance at 500 V DC	R_{is}	MOhm	1
Capacitance against housing	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 35: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0120
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Reduction of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting orientation			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	288
Allowed switching frequencies[1)]	f_s	kHz	4 ... 16
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	839
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Lateral minimum distance at the device[3)]	d_{hor}	mm	0 (for devices in the DC bus group) 10 (for devices outside of the DC bus group)

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

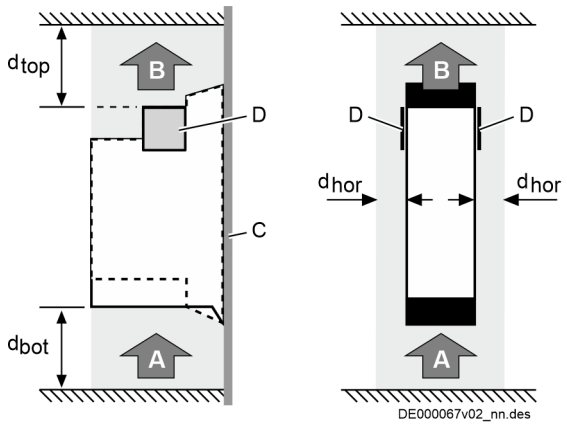
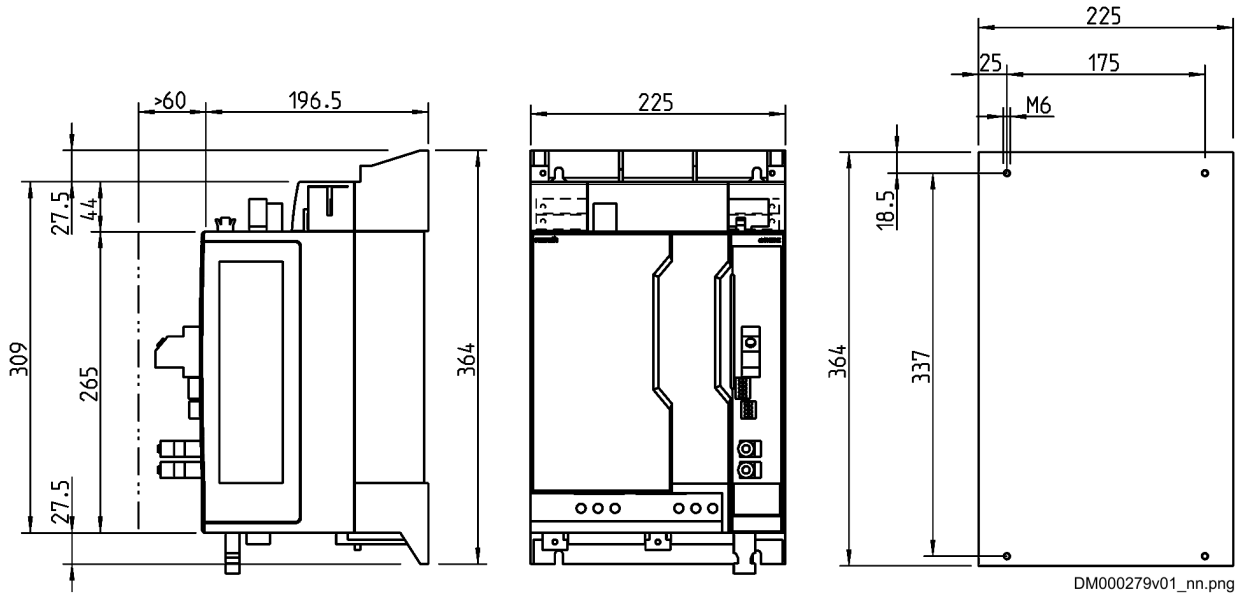


Fig. 28: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

7.4.7 Single-axis converter XCS*-W0150

Dimensional drawing



Dimensions, weight, insulation

Table 36: Data for weight, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0150
Weight	m	kg	17
Device height[1)]	H	mm	309
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	225
Insulation resistance at 500 V DC	R_{is}	MOhm	1
Capacitance against housing	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 37: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0150
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Reduction of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting orientation			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	296
Allowed switching frequencies[1)]	f_s	kHz	4 ... 16
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	1211
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Lateral minimum distance at the device[3)]	d_{hor}	mm	0 (for devices in the DC bus group) 10 (for devices outside of the DC bus group)

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

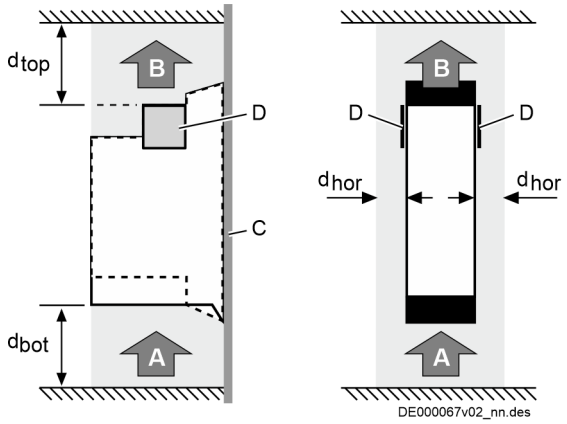
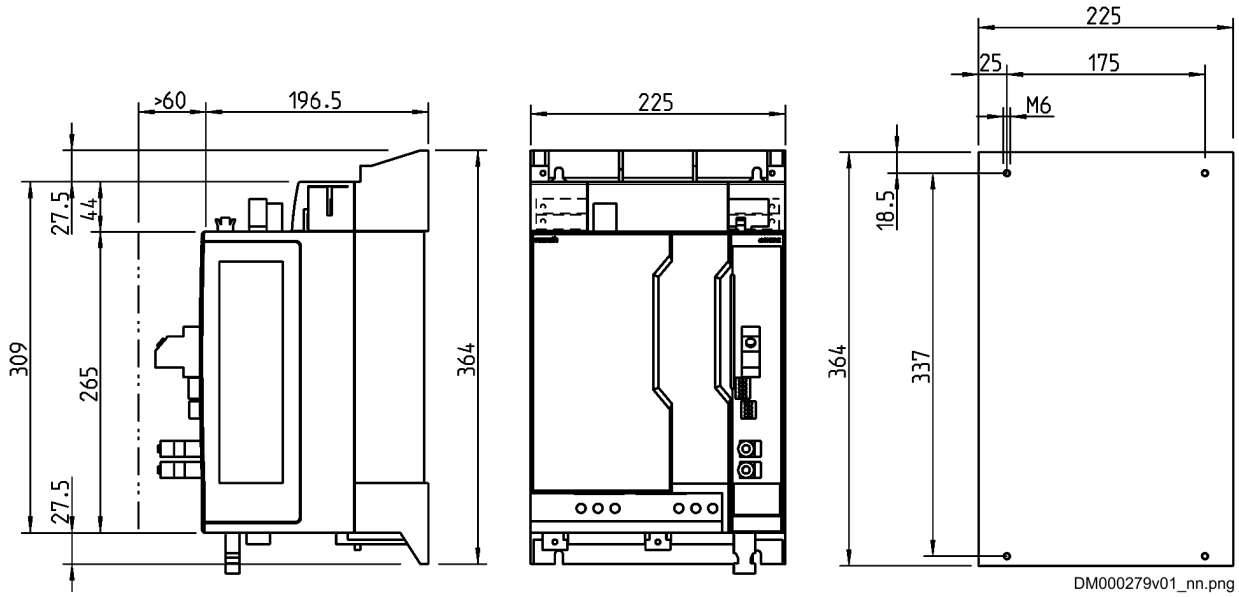


Fig. 29: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in control cabinet
D Touch guard plate at the device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm) ×
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

7.4.8 Single-axis converter XCS*-W0180

Dimensional drawing



Dimensions, weight, insulation

Table 38: Data for weight, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0180
Weight	m	kg	17
Device height[1)]	H	mm	309
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	225
Insulation resistance at 500 V DC	R_{is}	MOhm	1
Capacitance against housing	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 39: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0180
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Reduction of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2
Allowed mounting orientation			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	296
Allowed switching frequencies[1)]	f_s	kHz	4 ... 16
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	1485
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Lateral minimum distance at the device[3)]	d_{hor}	mm	0 (for devices in the DC bus group) 10 (for devices outside of the DC bus group)

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

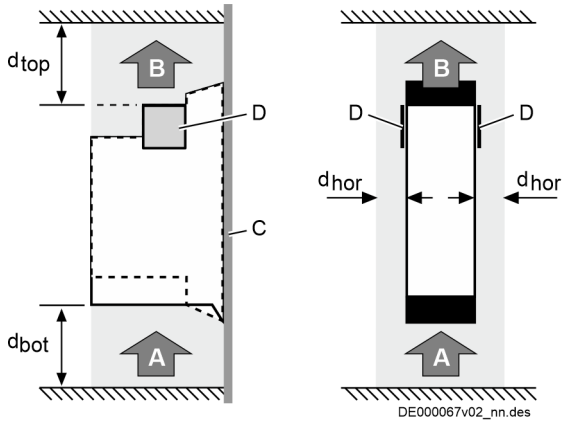
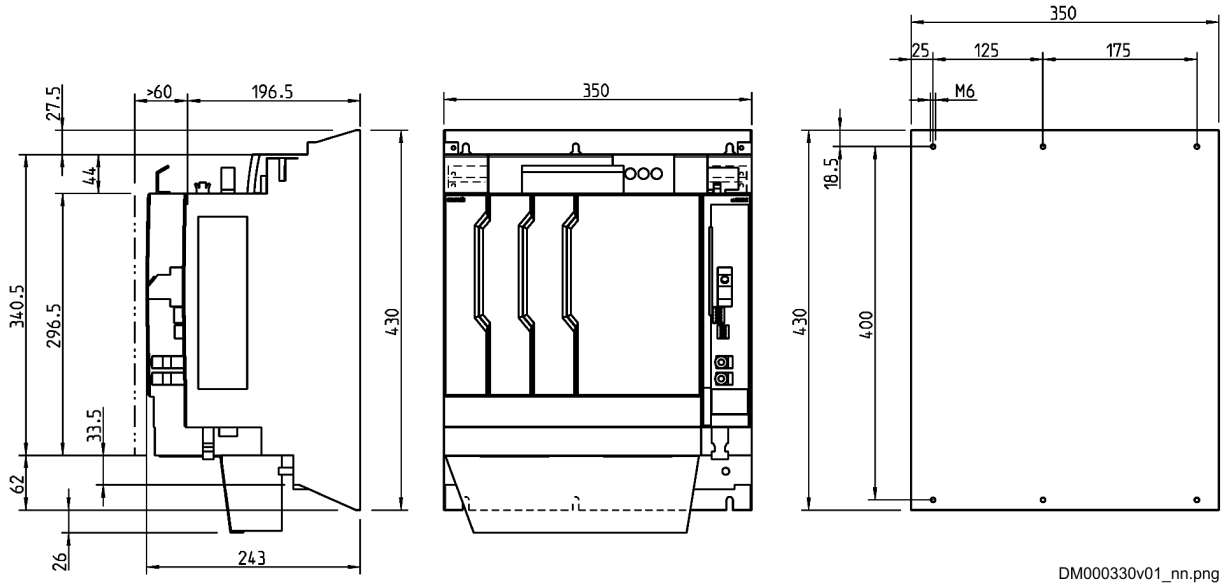


Fig. 30: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

7.4.9 Single-axis converter XCS*-W0210

Dimensional drawing



Dimensions, weight, insulation

Table 40: Data for weight, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0210
Weight	m	kg	27
Device height[1)]	H	mm	340.5
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	350
Insulation resistance at 500 V DC	R_{is}	MOhm	1
Capacitance against housing	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 41: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0210
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Reduction of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	tbd
Allowed mounting orientation			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	444
Allowed switching frequencies[1)]	f_s	kHz	4 ... 16
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	1704
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Lateral minimum distance at the device[3)]	d_{hor}	mm	0 (for devices in the DC bus group) 10 (for devices outside of the DC bus group)

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

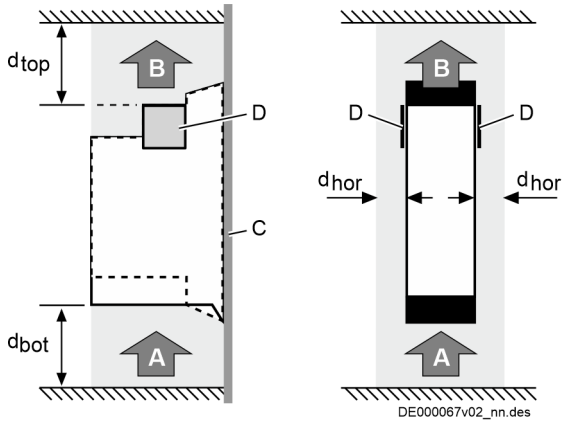
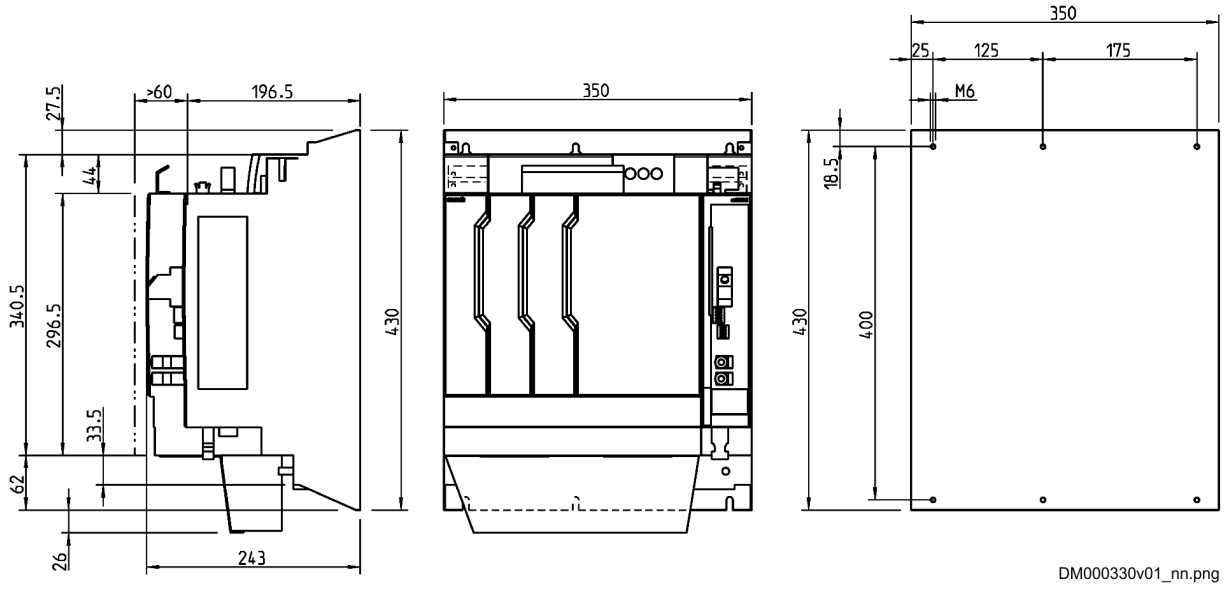


Fig. 31: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

7.4.10 Single-axis converter XCS*-W0250

Dimensional drawing



Dimensions, weight, insulation

Table 42: Data for weight, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0250
Weight	m	kg	27
Device height[1)]	H	mm	340.5
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	350
Insulation resistance at 500 V DC	R_{is}	MOhm	1
Capacitance against housing	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 43: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0250
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Reduction of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	tbd
Allowed mounting orientation			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	444
Allowed switching frequencies[1)]	f_s	kHz	4 ... 16
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	1882
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Lateral minimum distance at the device[3)]	d_{hor}	mm	0 (for devices in the DC bus group) 10 (for devices outside of the DC bus group)

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

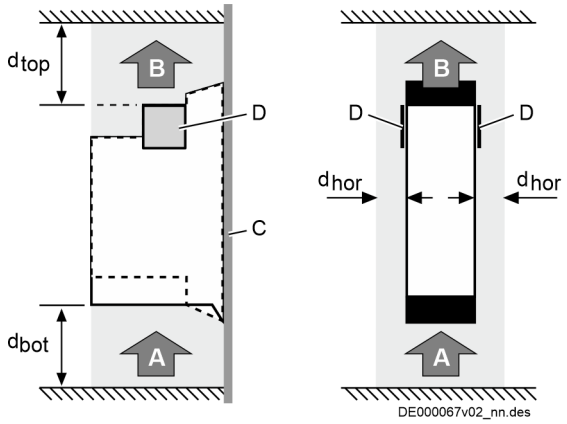
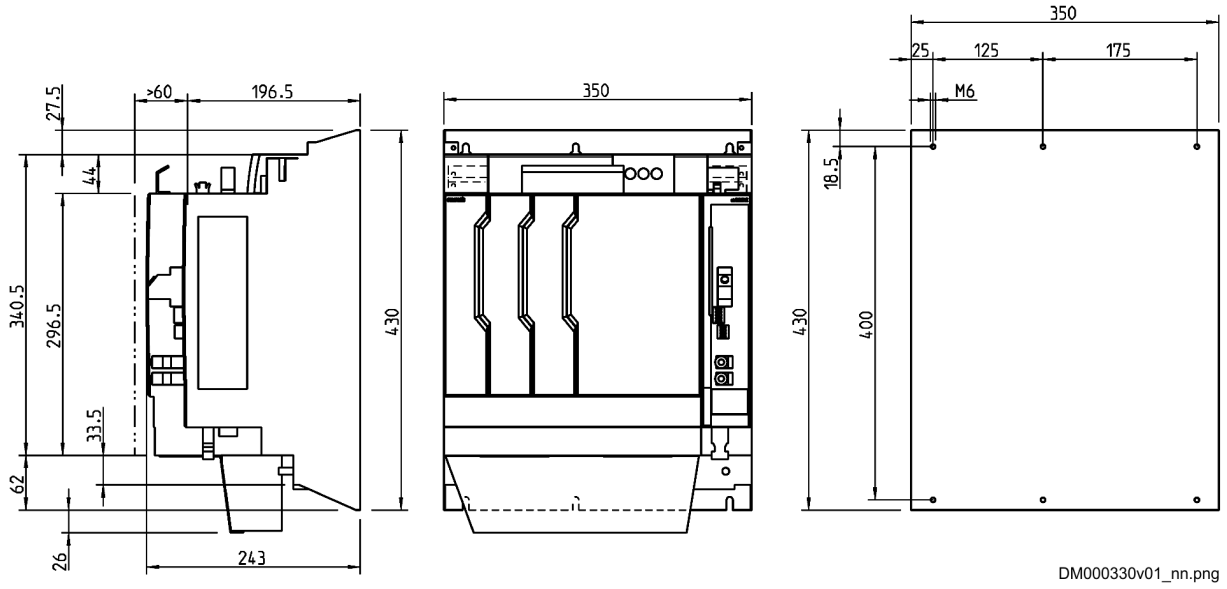


Fig. 32: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

7.4.11 Single-axis converter XCS*-W0280

Dimensional drawing



Dimensions, weight, insulation

Table 44: Data for weight, dimensions, insulation

Designation	Symbol	Unit	XCS*-W0280
Weight	m	kg	27
Device height[1)]	H	mm	340.5
Device depth[2)]	T	mm	196.5
Device width[3)]	B	mm	350
Insulation resistance at 500 V DC	R_{is}	MOhm	1
Capacitance against housing	C_Y	nF	2 × 100

1) 2) 3) Housing dimension; see also related dimensional drawing

Temperatures, cooling, power dissipation, distances

Table 45: Cooling and power dissipation data

Designation	Symbol	Unit	XCS*-W0280
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0 ... 40
Ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	40 ... 55
Reduction of P_{DC_cont}, P_{BD} I_{out_cont} at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	tbd
Allowed mounting orientation			G1
Cooling type			Forced ventilation
Volumetric capacity of forced cooling	V	m^3/h	444
Allowed switching frequencies[1)]	f_s	kHz	4 ... 16
Power dissipation at continuous current and continuous DC bus power respectively[2)]	P_{Diss_cont}	W	1987
Minimum distance on the top of the device[3)]	d_{top}	mm	80
Minimum distance on the bottom of the device[3)]	d_{bot}	mm	80
Lateral minimum distance at the device[3)]	d_{hor}	mm	0 (for devices in the DC bus group) 10 (for devices outside of the DC bus group)

1) Also depending on firmware and control section

2) Plus dissipation of braking resistor and control section

3) See fig. "Air intake and air outlet at device"

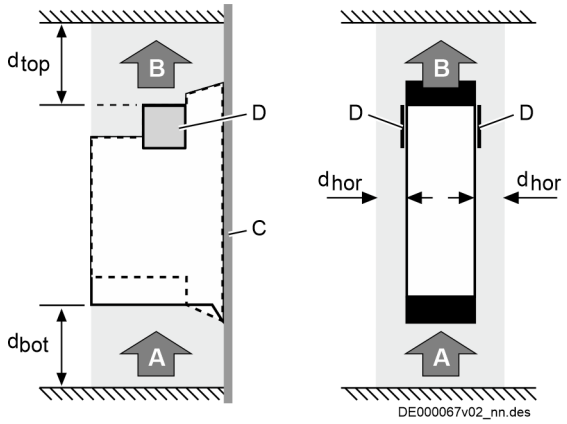


Fig. 33: Air intake and air outlet at device

A Air intake
B Air outlet
C Mounting surface in the control cabinet
D Touch guard plate at device (thickness: 1.5 mm = d_{hor} for individual supply); thus, with two individually supplied devices mounted side by side there is no distance (0 mm) between the touch guard plates, and below the touch guard plates there is a distance of 3 mm (2 × 1.5 mm)
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

7.4.12 Braking resistor HLR01

HLR01.1N-xxxx-Nxxx-A-007-NNNN braking resistors convert generated kinetic energy into thermal energy.

⚠ CAUTION	**Connection cable** Dimension the electric strength of the connection cables according to the switch-on threshold of the braking resistor.

Table 46: DC bus resistor units HLR

Type	Use
HLR01.1N	Type of construction N (version for free installation): braking resistors for free installation

Types of design:

- Fixed resistor IP 20 **Type A**
  Cement-coated, wire-wound, tube-type fixed resistors; screwed on side walls; perforated cover; connections in terminal box with PG glands
- Steel-grid fixed resistor IP 20 **Type B**
  Fixed resistor in steel-grid design; connection depending on type

Basically, all HLR01.1 types can be used that comply with the requirements on the minimum resistance, the continuous power and peak power, as well as the regenerative power to be absorbed (see technical data of the component (chapter “External braking resistor/integrated braking transistor” in the Project Planning Manual R911386579, ctrlX DRIVE Drive Systems).

Selecting an HLR01 braking resistor:

HLR01.1N-XXXX-NYYY-A-007-NNNN

- XXXX continuous power (e.g., 07K0 = 7 kW)
- YYY resistance value (e.g., 14R0 = 14 ohm)

See documentation “Rexroth IndraDrive, Additional Components and Accessories, Project Planning Manual, R911306140” for selecting an HLR01 braking resistor.

7.4.13 Additional components mains filters XNF and power choke XNL

Information on mains filters XNF and mains chokes XNL can be found in Project Planning Manual R911386579.

In some cases, mains filters HNF01.x and mains chokes HNL01.x are used. Information on mains filters XNF and mains chokes XNL can be found in Project Planning Manual R911342564.

7.5 Connecting the Sytronix system SvP 7030 electrically

7.5.1 General information

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V!** Fatal electric shock! Before starting work at live components: – De-energize installation and secure power switch against unintentional or unauthorized reconnection. – Before accessing the device, wait at least 30 minutes after switching off the supply voltages to allow discharging. – Check that the voltage has fallen below 50 V before touching live parts! – Never operate the drive controller without touch guard.

In this chapter we only describe components that are commonly used in an SvP system. This description does not cover device variants with CORE, modular systems, double or multiple devices, SafeMotion. For these components please observe the mounting instructions in Project Planning Manual R911386579. Here you can also find notes on accessories such as connector sets, shield connections, DC bus adapters, touch guards and DC bus chokes.

7.5.2 Input and output assignment at drive controller ctrlX DRIVE

Standard wiring diagram

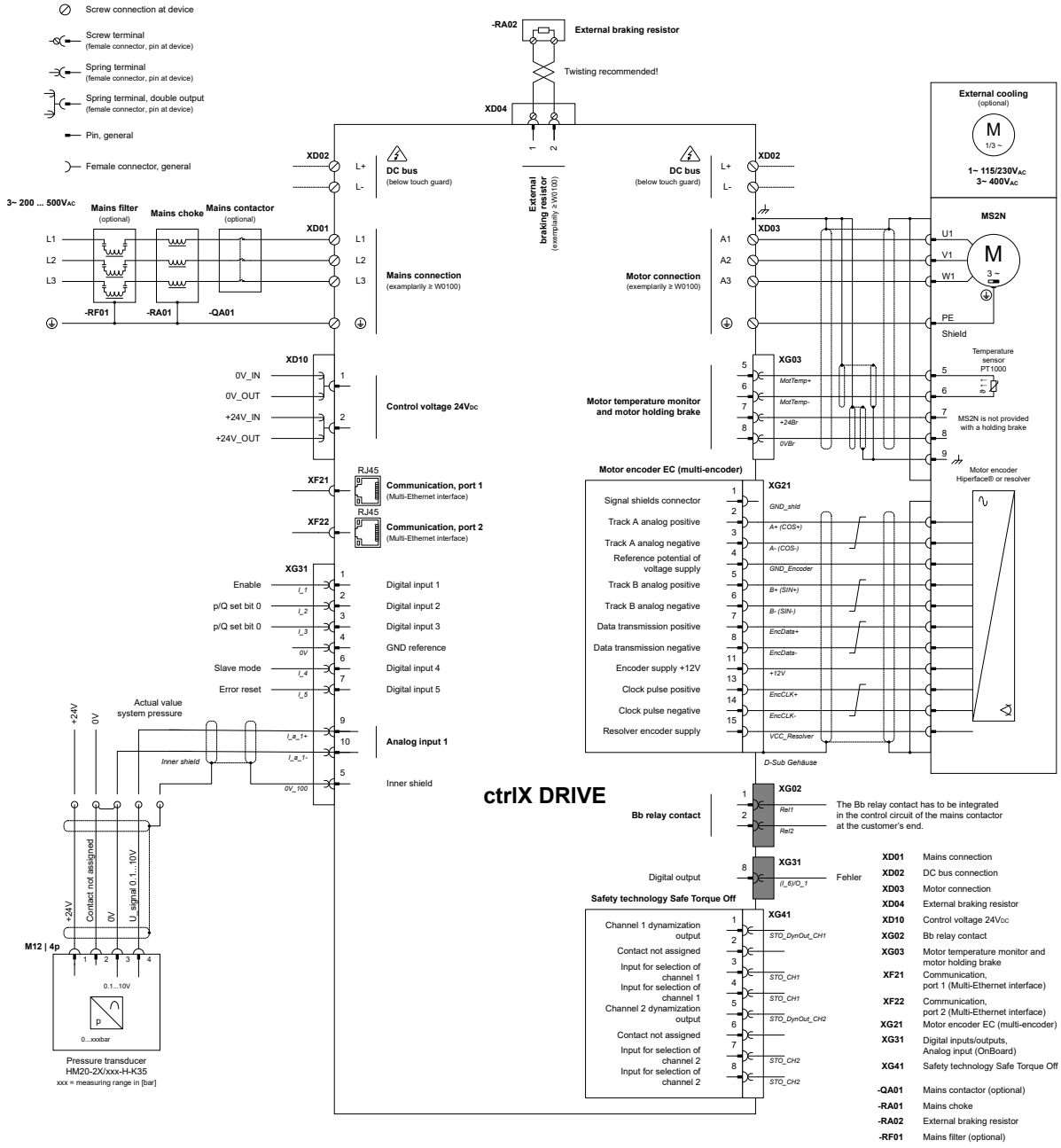


Fig. 34: Overview of ctrlX DRIVE topology

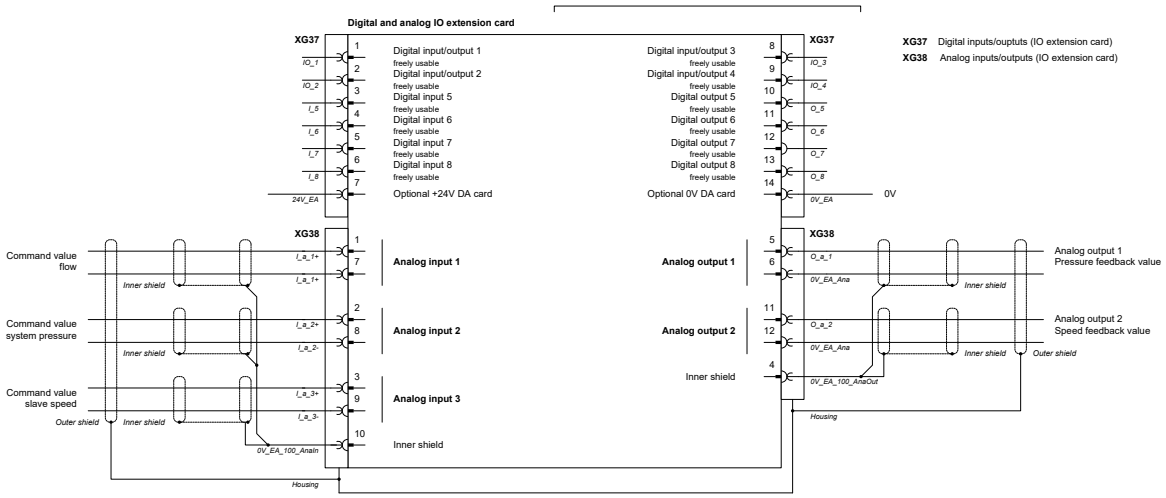


Fig. 35: Topology of extension card

7.5.3 Mains connection

Residual-current-operated circuit breakers (RCD, RCCB) as additional fusing

General

The following designations are commonly used for residual-current-operated circuit breakers:

- RCCB (Residual Current operated Circuit-Breaker)
- RCD (Residual Current Device)
- RCM (Residual Current Monitoring Device)
- Earth leakage circuit breaker (independent of voltage)
- Differential current circuit breaker (voltage-dependent)

It is only to a limited extent that residual-current-operated circuit breakers can be used with ctrlX DRIVE systems.

If these protective devices are to be used, the installer of the system has to check the mutual compatibility between the residual-current-operated circuit breaker and the system or the machine with the drive system to avoid unintended triggering of the residual-current-operated circuit breaker. This has to be complied with

- during switch-on operations due to higher unbalanced switch-on currents and
- during operation of the system due to leakage currents that occur during normal operation

Using residual-current-operated circuit breakers at drive controllers

Drive controllers at residual-current-operated circuit breaker

A residual-current-operated circuit breaker may be used under the following conditions:

- The residual-current-operated circuit breaker is of type B (IEC 60755)
- Trip limit of the residual-current-operated circuit breaker is ≥ 300 mA
- Supplying TN-S mains
- Maximum length of motor cable 20 m, shielded
- An XNF mains filter is used

- Each residual-current-operated circuit breaker only supplies one drive controller
- Only Bosch Rexroth components and accessories including cables and filters are used

Motor cable lengths

Keep motor cables as short as possible. Only short motor cables make low leakage currents possible and thereby enable residual-current-operated circuit breakers to work.

Using isolating transformer to reduce leakage current in mains

If no improvement is achieved and the residual-current-operated circuit breaker, due to specific mains conditions on site, has to be used nevertheless on the mains input side, connect an isolating transformer between mains connection and power connection of the drive system. This reduces the leakage current in the ground wire of the mains that is produced during normal operation which allows the residual-current-operated circuit breaker to be used. Connect the neutral point of the output winding of the isolating transformer to the protective earth conductor of the drives system.

Match the impedance of the fault loop with the overcurrent protection device in order that switching off takes place in the event of a fault.

Before enabling operation, test the overcurrent protection device for proper function with tripping in the event of a fault.

Exclusive fusing by residual-current-operated circuit breaker

For drive systems with electronic device controllers, fusing exclusively by means of a residual-current-operated circuit breaker is usually not possible and not permitted.

Electronic equipment that has a nominal power higher than 4 kVA or is destined for permanent connection normally does not need residual-current-operated circuit breakers. Observe the country-specific standards.

According to IEC 60204-1 and IEC 61800-5-1, the mains-side protection against indirect contact, i.e. in the case of insulation failure, has to be provided in a different way, for example by means of an overcurrent protection device, protective grounding, protective-conductor system, protective separation or total insulation.

Mains choke

When using mains chokes, observe their effect on connected drive controllers. Due to their inductance, mains chokes have a smoothing effect on current, thus reducing harmonics.

Take the nominal current of the mains choke into account in order that the inductance of the mains choke is available.

Certain main chokes are assigned to some drive controllers (see technical data of the drive controller “Mains voltage supply data → Assigned mains choke type").

Mains contactor

The mains contactor is optional.

Required input data:

- Nominal current I_{LN} of the drive controller
- Number of drive controllers to be connected to the mains contactor

When using mains contactors of utilization category AC-1, observe the conventional thermal continuous current I_{th} (see data sheet of mains contactor) when dimensioning the mains contactor.

The required minimum conventional thermal continuous current I_{th} results from the sum of the nominal currents ΣI_{LN} of all connected drive controllers.

Control circuit for the mains connection

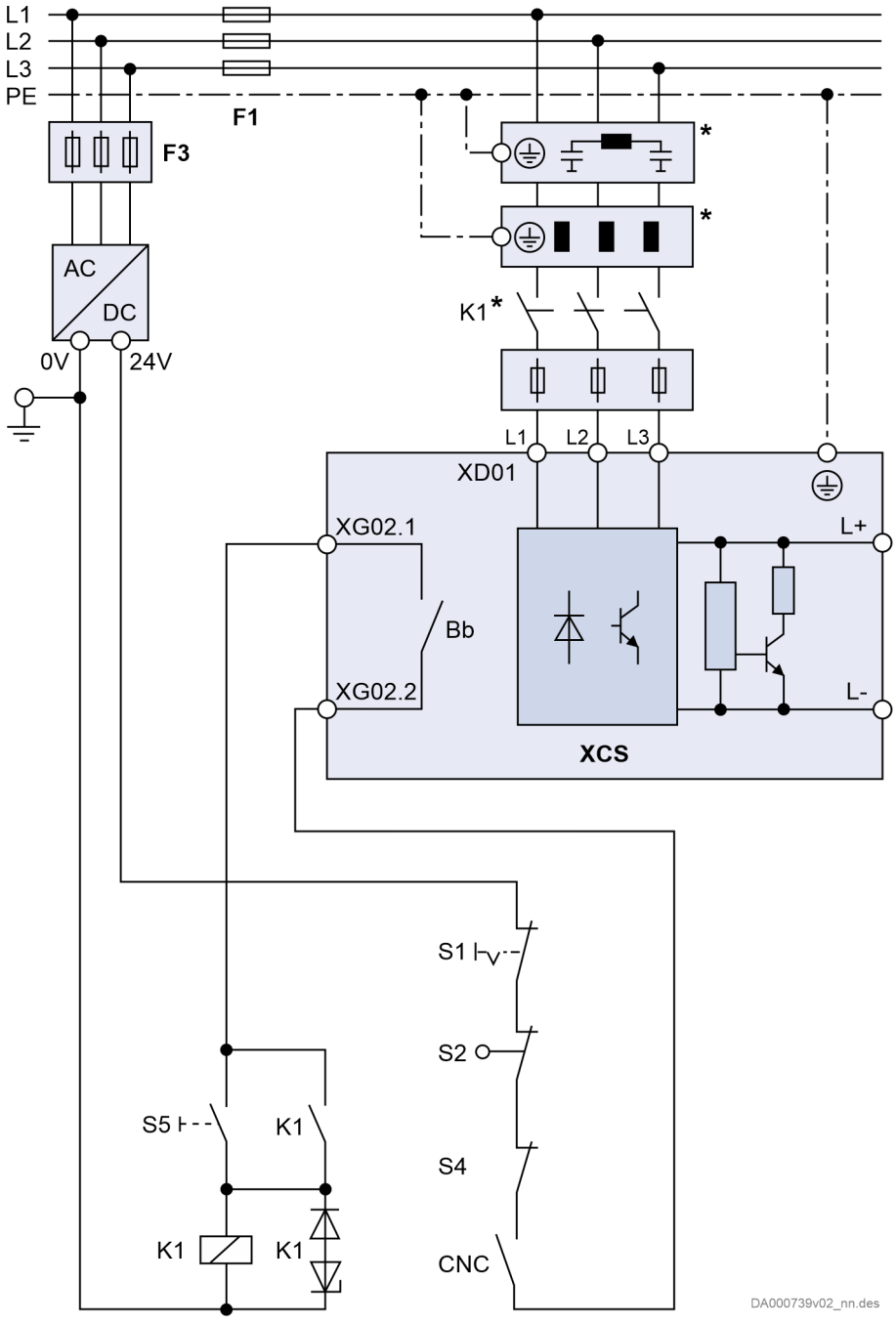


Fig. 36: Control circuit for the mains connection

* Optional
Bb Bb relay contact
CNC Lag error message of control unit
F1 Fuse of power supply
F3 Fuse of 24 V power supply unit

K1 External mains contactor
S1 Emergency stop
S2 Axis end position
S4 Power OFF
S5 Power ON

7.5.4 Control voltage

Control voltage for drive systems

Some components of a drive system have to be supplied with control voltage. When selecting a control voltage supply, observe the requirements of the components in the drive system:

- depending on the motor cable length and the use of motor holding brakes **the allowed mains input voltage tolerance**
- Power consumption of the **drive controllers**
- Power consumption **of further consumers** (e.g., motor holding brakes, digital outputs)
- **Current carrying capacity of connection point** for control voltage supply at the component for the purpose of looping through the control voltage to other components

Control voltage supply

Determining the power requirement

Power requirement of the drive controller

The **total power requirement** of the control voltage supply of a drive controller results from the sum of the following power values:

- Basic device (drive controller without connected encoders)
- Optional connection interfaces (e.g. communication, additional encoder evaluation)
- Connected encoder systems
- External loads

For the configuration of your drive controller, see the nameplate and the type code.

The tables below contain the individual power values required by the drive controller. The power requirement of the supplying 24V power supply unit results from the sum of these individual power values.

Power requirement

Device		Power requirement [W]									
		Basic device	Options				External/customer-specific				Panel
			ET	EC	T0[1)]	X3 (CORE)	Digital output	Encoder (EC)	Encoder (onboard)	Dynamic input (T0, M5)	XDP1
XCS	W0023	12.1	1.4	0.9	0.5	9.8	0...12	0...3.6	0...2.4	0...7.2	0.9
	W0054	54									1.9 [2)]
	W0070	47									
	W0100	35.6									
	W0120	35.6									
	W0150	61									
	W0180	75									
	W0210 ... W0280	71.5									

1) ctrlX DRIVE per device; ctrlX DRIVE plus: per axis
2) ctrlX DRIVE with CORE and optional USB on-the-go

Requirements on the 24 V power supply unit

PELV (Protective Extra-Low Voltage) for the 24 V power supply unit

Use a power supply unit or a control transformer with PELV protection according to IEC 60204-1 (section 6.4) for the 24 V supply of devices of the ctrlX DRIVE drive family.

For the scope of CSA/UL, a UL508-certified power supply unit has to be used.

The following **technical data** contain the basic requirements on the 24 V power supply unit:

- **Output voltage** or output voltage range
- **Continuous power**that the 24 V power supply unit has to provide during operation
- **Peak current**that the 24 V power supply unit has to supply when switching on

Required continuous power

The continuous power of the 24 V power supply unit has to be greater than the sum of the power consumptions P_{N3} of the components to be supplied.

To select the 24 V power supply unit, determine the continuous current I_{N3} of all components:

$I_{N3} = P_{N3} / U_{N3}$

(P_{N3} : power consumption of all components)

The calculated current I_{N3} corresponds to the continuous current of the 24 V power supply unit.

The power consumption is specified as the maximum value of the respective component and can occur **at individual components** .

In drive packages with **several components,** the occurring power consumption under statistical assumptions will be lower than the calculated one.

Required peak current

When the 24 V control voltage unit is switched on, the 24 V power supply unit is loaded with the charging current of the capacitors of the connected components. This charging current is electronically limited in the components.

The required peak current of the power supply unit is calculated with:

$I_{PeakCurrent\_PowerSupplyUnit} = 1.2 \times P_{N3} / U_{N3}$

(P_{N3} : power consumption of all components)

The power supply unit has to provide the calculated peak current $I_{PeakCurrent\_PowerSupplyUnit}$ for at least one second.

Installing the 24 V supply

NOTICE	**Risk of damage to the braking resistor after the control voltage supply was switched back on**
	Do not switch off the control voltage supply during operation. In case the control voltage supply fails: Let the braking resistor cool down before switching back on. Cooling time: > 5 × (W_{R_max} [kWs] ÷ P_{BD} [kW]) W_{R_max}: absorbable regenerative power of braking resistor, P_{BD}: Braking resistor continuous power

Installation instructions

- The 24 V supply of the ctrlX DRIVE system components should be installed in a **star layout.** This means it is necessary to run separate supply lines for each group of drive controllers or third-party components. This, too, applies to multiple-line arrangement in the case of supply from a supply unit, for example.
- Run lines with sufficiently dimensioned line cross sections to reduce load-dependent voltage drops.
- For looping through the control voltage, observe the maximum current carrying capacity of the connection points. The maximum current carrying capacity limits the number of devices to which the control voltage can be looped through.

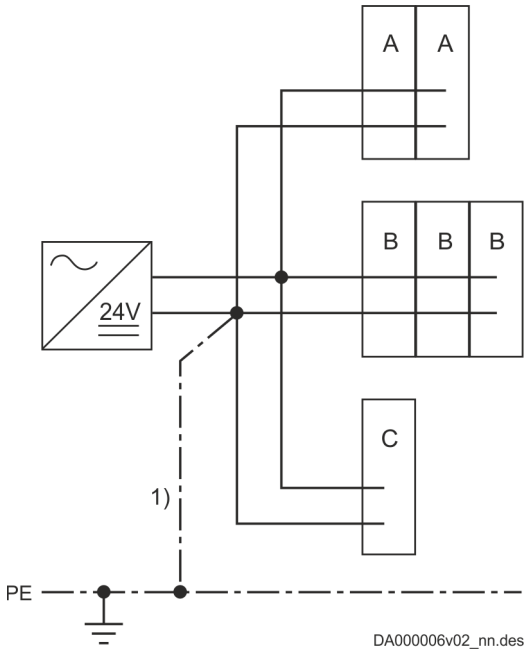


Fig. 37: Installing the 24 V supply

A Number of devices is limited to x components with a total current consumption smaller than the current carrying capacity of the connection point

B Number of devices is limited to y components with a total current consumption smaller than the current carrying capacity of the connection point

C Third-party component (e.g., PLC, valve etc.)

1) Connection to central ground point (e.g., equipotential bonding bar PE)

If you use multiple 24 V power supply units:

- Output voltages of the 24 V power supply units have to be within the allowed voltage range
- Interconnect 0 V reference conductors of the individual 24 V power supply units with low impedance
- Always switch 24V power supply units on and off synchronously

Chronological order of 24 V supply and mains voltage

Before mains voltage or DC bus voltage is applied to the components, they have to be supplied by the 24 V supply.

Looping through the control voltage

NOTICE	**Property damage in case of error from line cross section being too small!**
	Observe the current carrying capacity of the connection points for control voltage supply at the components used.

You are only allowed to loop through the control voltage between the components, if the **sum** of current consumptions ΣI_{N3} of the individual components is smaller than the current carrying capacity of the connection point.

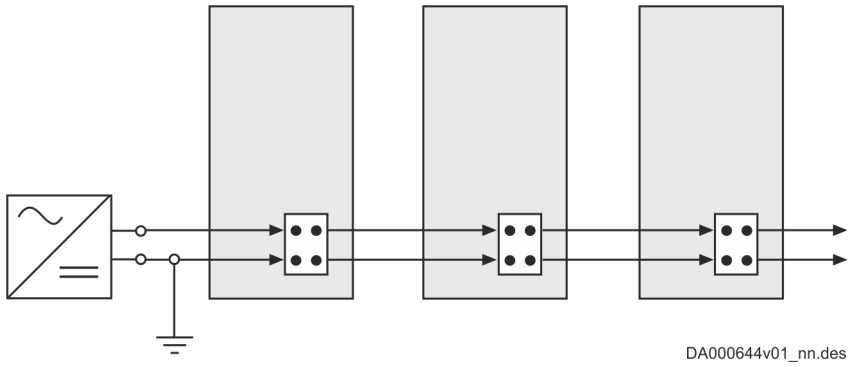


Fig. 38: Looping through the control voltage

Exemplary calculation for 3 drive controllers:

$$I_D = 3 \times \frac{P_{N3}}{U_{N3}}$$

Fig. 39: Continuous current

The result I_D has to be smaller than the specified current carrying capacity of the connection point.

7.5.5 Specification of the digital/analog inputs/outputs

Digital inputs type A (standard)

The digital inputs comply with IEC 61131-2.

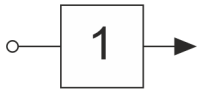


Table 47: Digital inputs type A

Datum	Unit	Min.	Max.
Allowed input voltage	V	-3	30
High	V	15	30
Low	V	-3	5
Input current	mA	2	5
Delay time	µs		100 + position controller clock cycle

Digital inputs (safety technology Safe Torque Off)

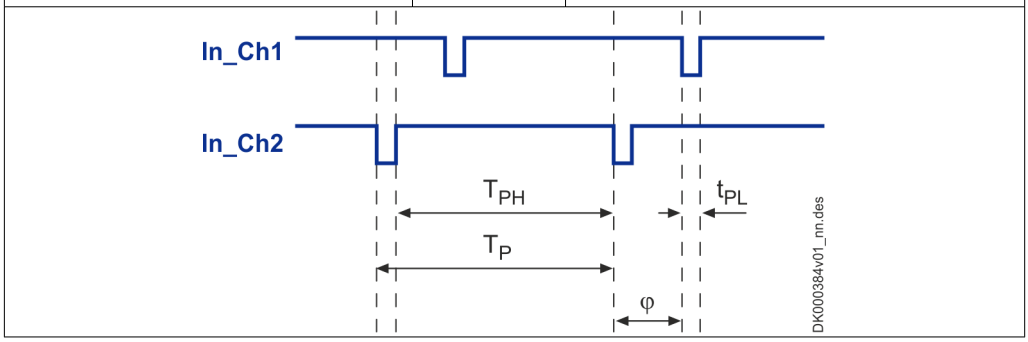
The digital inputs comply with IEC 61131-2.

Table 48: Digital inputs (safety technology)

Datum	Unit	Min.	Max.
Allowed input voltage	V	-3	30
High	V	15	30
Low	V	-3	5
Current consumption	mA	2	5

Table 49: Time behavior

Designation	Unit	Min.	Max.
Test pulse width (t_{PL})	µs	100	3000
Periodic time	s	0.1	3600
Phase shift between two test pulses on both channels (φ)	ms	not specified	



Digital outputs (standard)

The digital outputs are compatible with digital inputs of types 1, 2 and 3 (IEC 61131).

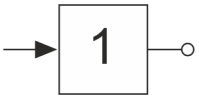


Table 50: Digital outputs

Datum	Unit	Min.	Max.
Output voltage ON [1]	V	U_{ext} - 1	U_{ext}
Output current OFF	mA		0.05
Output current ON	mA		500
Allowed energy content of connected inductive loads [2] [3] • f < 0.5 Hz • f < 2 Hz	mJ		 500 200
Delay time	µs		100 + position controller clock cycle
Short-circuit protection		Included	
Overload protection		Included	

1) U_{ext}: Supply voltage

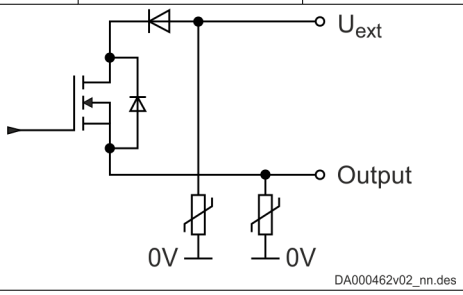
2) In the case of inductive loads with a greater energy content, an external free-wheeling arm has to be installed. The effective terminal voltage has to be < 25 V.

3) The maximum energy content depends on the switching frequency f of outputs

Digital outputs (safety technology Safe Torque Off)

The digital outputs are compatible with digital inputs IEC 61131-2.

Table 51: Digital outputs

Datum	Unit	Min.	Max.
Output voltage ON	V	U_{ext} - 1	U_{ext}
Output voltage OFF	V		5
Allowed output current per output	mA		350
Allowed energy content of connected inductive loads, e.g. relay coils	mJ		400 [1) 2)]
Capacitive load	nF		50 × n_{DI} [3)]
Short-circuit protection		Present	
Overload protection		Present	
Block diagram, output:			
Fault detection	The following errors are recognized: • Wiring error with short-circuit to High • Wiring error with short-circuit to Low • Wiring error with short-circuit between the two channels • Internal error In the event of an error, the control panel displays an error message: F830x, F3134		

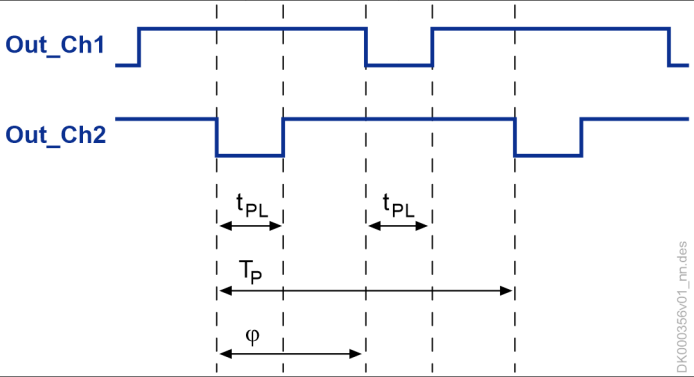
1) At a maximum switching frequency of 1 Hz

2) In the case of inductive loads with currents > 200 mA or in the case of inductive loads with a greater energy content, an external free-wheeling arm has to be installed. The effective terminal voltage has to be < 25 V.

3) n_{DI}: Number of digital inputs that are used for a digital output

Table 52: Time behavior

Designation	Unit	Typ.
Test pulse width (t_{PL})	µs	400
Cycle duration (T_P)	ms	500
Phase shift between two test pulses on both channels (φ)	°	180



Analog voltage input

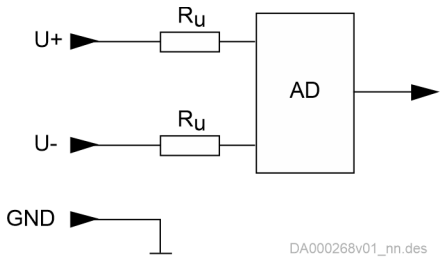


Fig. 40: Analog voltage input
AD: Analog/digital converter

Table 53: Analog voltage input

Datum	Unit	Min.	Typ.	Max.
Allowed input voltage	V	-30		+30
Operating range of input voltage U_{in_work}	V	-10		+10
Input resistance R_u	kΩ	150		300
Input bandwidth (-3 dB):	kHz		1.3	
Common-mode range	V	-30		+30
Common-mode rejection	dB	50		
Relative measuring error at 90 % U_{in_work}	%	-1		+1
Resolution	Bit		12	
Cable		In case of cable lengths **> 30 m** use **shielded** cables only.		

7.5.6 Overall connection diagram XCS*-W0023

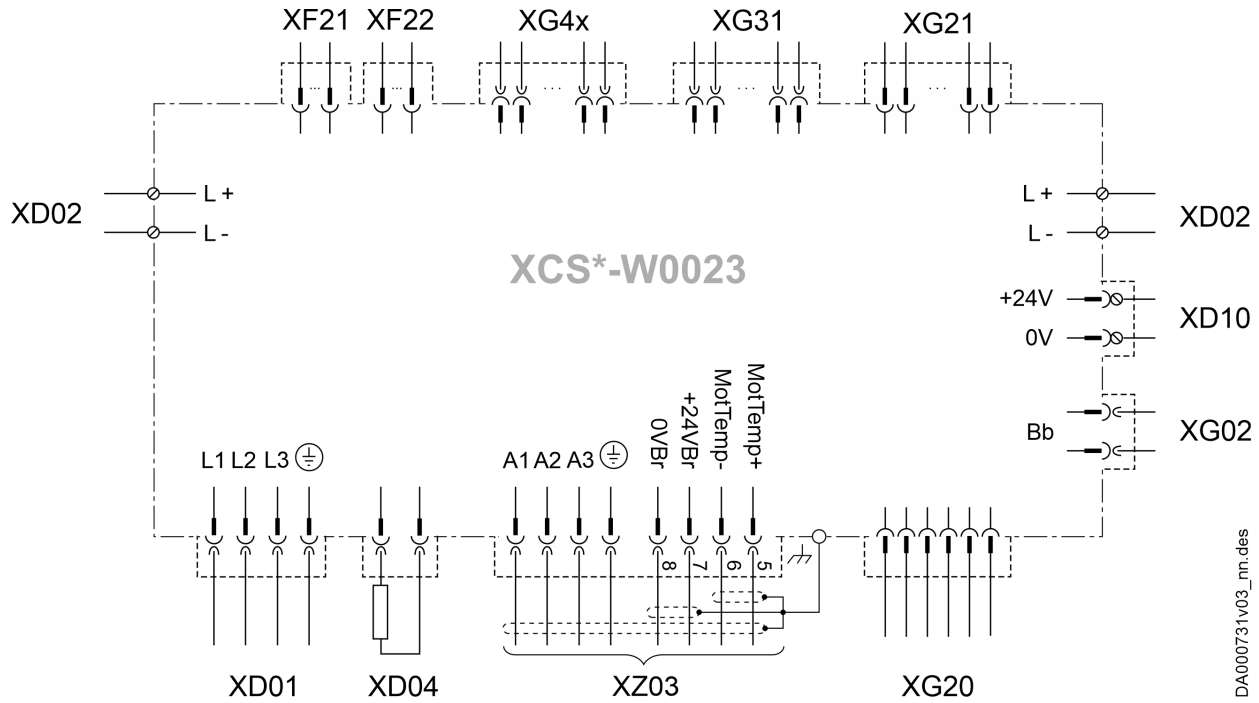


Fig. 41: Overall connection diagram XCS*-W0023

XD01	Mains	XG20	Digital encoder
XD02	DC bus	XG21	Multi-encoder (optional)
XD04	Internal/external braking resistor	XG31	Digital inputs/outputs; analog input
XD10	Control voltage	XG4x	Safety technology
XF21, XF22	Communication	XZ03	Motor, motor temperature monitoring, motor holding brake
XG02	Ready-for-operation relay contact		

7.5.7 Overall connection diagram XCS*-W0054/W0070

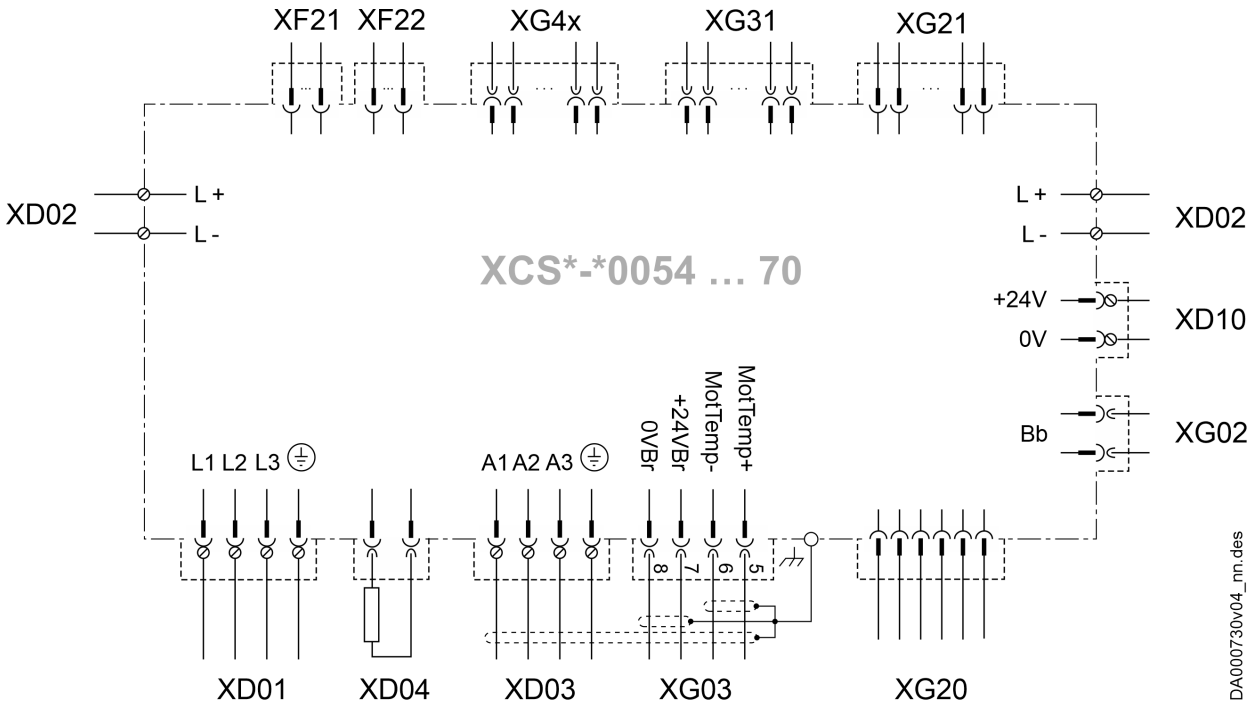


Fig. 42: Overall connection diagram XCS*-W0054/W0070

XD01	Mains	XG03	Motor temperature monitoring and motor holding brake
XD02	DC bus		
XD03	Motor	XG20	Digital encoder
XD04	External braking resistor	XG21	Multi-encoder (optional)
XD10	Control voltage	XG31	Digital inputs/outputs; analog input
XF21, XF22	Communication	XG4x	Safety technology
XG02	Ready-for-operation relay contact		

7.5.8 Overall connection diagram XCS*-W01xx

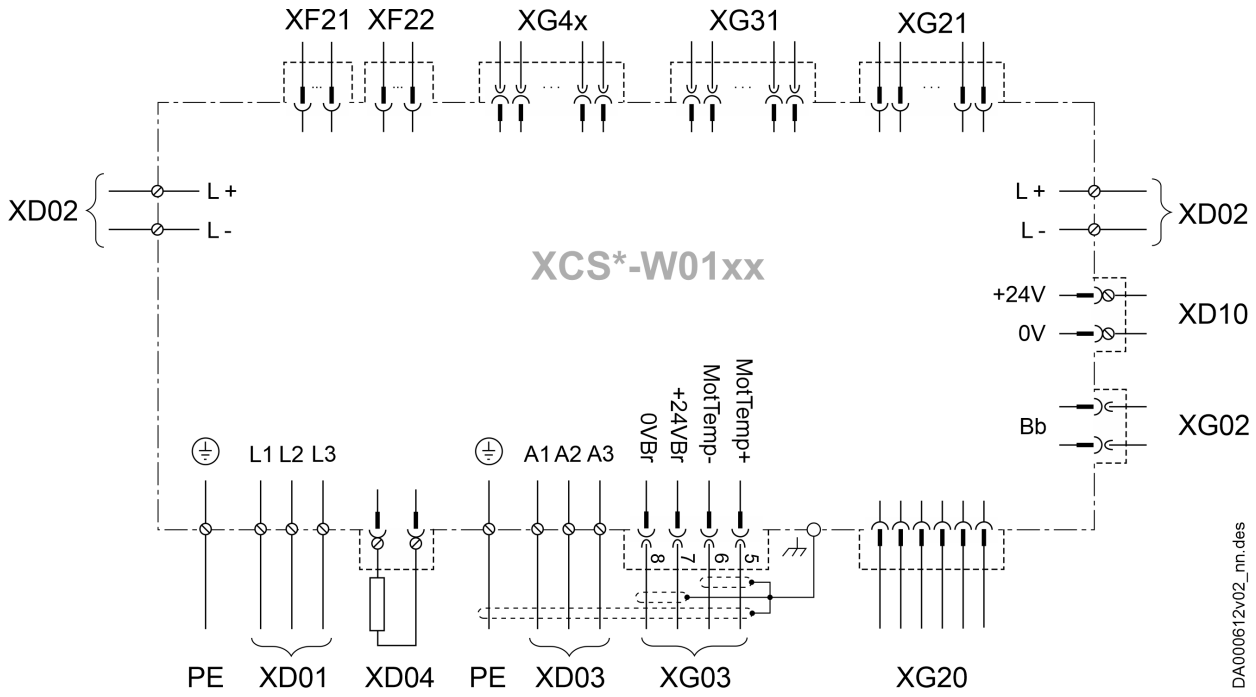


Fig. 43: Overall connection diagram XCS*-W01xx

XD01	Mains	XG03	Motor temperature monitoring and motor holding brake
XD02	DC bus		
XD03	Motor	XG20	Digital encoder
XD04	External braking resistor	XG21	Multi-encoder (optional)
XD10	Control voltage	XG31	Digital inputs/outputs; analog input
XF21, XF22	Communication	XG4x	Safety technology
XG02	Ready-for-operation relay contact		

7.5.9 Overall connection diagram XCS*-W02xx

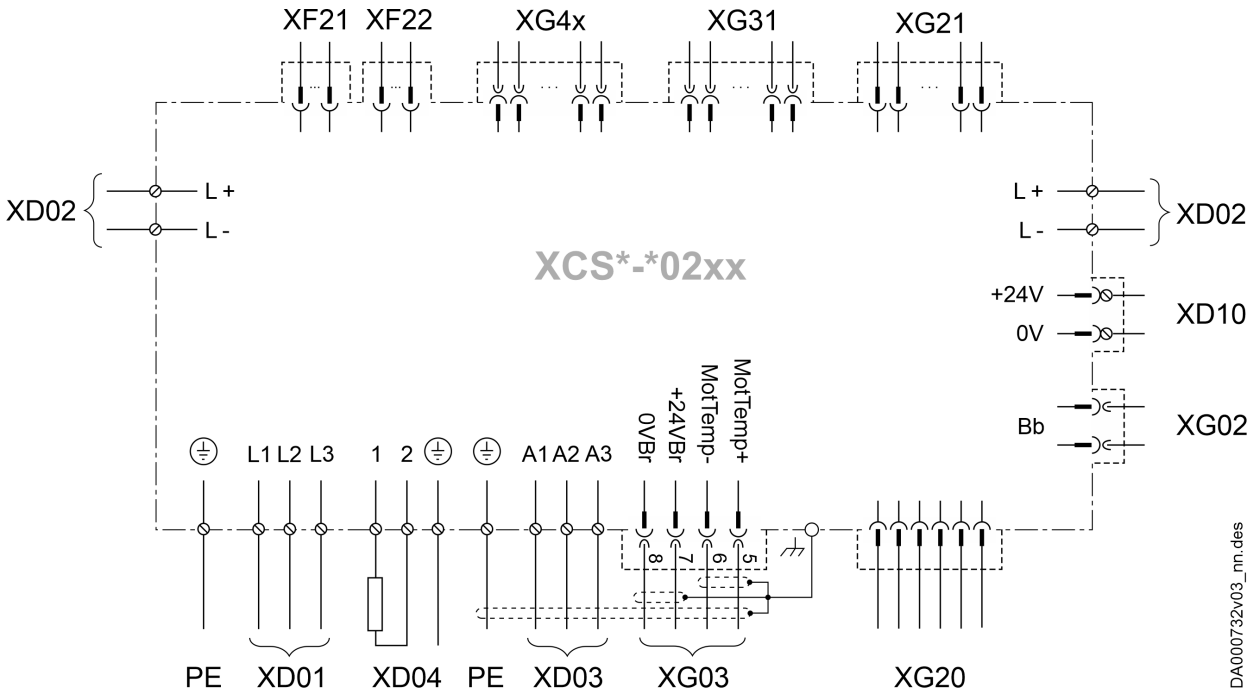


Fig. 44: Overall connection diagram XCS*-W02xx

XD01	Mains	XG03	Motor temperature monitoring and motor holding brake
XD02	DC bus		
XD03	Motor	XG20	Digital encoder
XD04	External braking resistor	XG21	Multi-encoder (optional)
XD10	Control voltage	XG31	Digital inputs/outputs; analog input
XF21, XF22	Communication	XG4x	Safety technology
XG02	Ready-for-operation relay contact		

7.5.10 Electrical data of single-axis converter XCS*-W0023

Control voltage

Table 54: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0023
Control voltage input[1)]	U_{N3}	V	24 ±20%
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4
Pulse width of I_{EIN3}	$t_{EIN3Load}$	ms	20
Input capacitance	C_{N3}	mF	tbd
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	12.1

1) 2) 3) Comply with supply voltage for motor holding brake

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

Mains voltage

Table 55: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0023
Mains frequency	f_{LN}	Hz	50 ... 60
Tolerance mains frequency		Hz	±2
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2
Rotating field condition			None
Short-circuit current rating	SCCR	A rms	42000
Nominal mains voltage	U_{LN_nom}	V	400
Mains voltage, single-phase	U_{LN}	V	Not permitted
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not permitted
Tolerance U_{LN}		%	+10 / -15
Minimum inductance of mains supply (mains phase inductance)[1)]	L_{min}	µH	40
Inrush current	$I_{L\_trans\_max\_on}$	A	tbd
Maximum allowed ON-OFF cycles per minute			20
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase)[2)]	I_{LN}	A	7.4

Designation	Symbol	Unit	XCS*-W0023
Mains fuse according to EN 602041 (three-phase)		A	10
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	tbd
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase)	S_{LN}	kVA	4

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire with PVC insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

Integrated braking resistor

Table 56: Integrated braking resistor data

Designation	Symbol	Unit	XCS*-W0023
Nominal resistance	$R_{DC\_Bleeder\_nom}$	ohm	75
Braking resistor continuous power	P_{BD}	W	80
Braking resistor peak power	P_{BS}	kW	8
Absorbable regenerative power	W_{R_max}	kWs	3.2
Switch-on threshold of braking resistor	$U_{R\_DC\_On\_f}$	V	820

External braking resistor/integrated braking transistor

Table 57: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0023
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	43.7
Maximum resistance	$R_{DC\_Bleeder\_max}$	Ohm	100
Braking transistor continuous power	P_{BD}	kW	2.3
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	500

7.5.11 Electrical data of single-axis converter XCS*-W0054

Control voltage

Table 58: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0054
Rated control voltage input[1)]	U_{N3}	V	24 ±20%
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4
Pulse width of I_{EIN3}	$t_{EIN3Load}$	ms	20
Input capacitance	C_{N3}	mF	1.7
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	47

1) 2) 3) Comply with supply voltage for motor holding brake

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

Mains voltage

Table 59: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0054
Mains frequency	f_{LN}	Hz	50 ... 60
Tolerance mains frequency		Hz	±2
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2
Rotating field condition			None
Short-circuit current rating	SCCR	A rms	42000
Nominal mains voltage	U_{LN_nom}	V	400
Mains voltage, single-phase	U_{LN}	V	Not permitted
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not permitted
Tolerance U_{LN}		%	+10 / -15
Minimum inductance of mains supply (mains phase inductance)[1)]	L_{min}	µH	40
Assigned mains choke type			XNL1-1E-0362-N0080-B-500-NNNN-NN
Inrush current	$I_{L\_trans\_max\_on}$	A	tbd
Maximum allowed ON-OFF cycles per minute			20

Designation	Symbol	Unit	XCS*-W0054
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)[2)]	I_{LN}	A	23.1
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)[3)]	I_{LN}	A	26.6
Mains fuse according to EN 60204-1 (three-phase, without mains choke)		A	32
Mains fuse according to EN 60204-1 (three-phase, with mains choke)		A	32
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	4
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)	S_{LN}	kVA	16
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)	S_{LN}	kVA	18.4

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire with PVC insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

Integrated braking resistor

Table 60: Integrated braking resistor data

Designation	Symbol	Unit	XCS*-W0054
Nominal resistance	$R_{DC\_Bleeder\_nom}$	ohm	14.2
Braking resistor continuous power	P_{BD}	W	320
Braking resistor peak power	P_{BS}	kW	31.8
Absorbable regenerative power	W_{R_max}	kWs	13
Switch-on threshold of braking resistor	$U_{R\_DC\_On\_f}$	V	820

External braking resistor/integrated braking transistor

Table 61: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0054
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	14
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	760
Braking transistor continuous power	P_{BD}	kW	8
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000

7.5.12 Electrical data of single-axis converter XCS*-W0070

Control voltage

Table 62: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0070
Control voltage input[1)]	U_{N3}	V	24 ±20%
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4
Pulse width of I_{EIN3}	$t_{EIN3Load}$	ms	20
Input capacitance	C_{N3}	mF	1.7
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	47

1) 2) 3) Comply with supply voltage for motor holding brake

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

Mains voltage

Table 63: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0070
Mains frequency	f_{LN}	Hz	50 ... 60
Tolerance mains frequency		Hz	±2
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2
Rotating field condition			None
Short-circuit current rating	SCCR	A rms	42000
Nominal mains voltage	U_{LN_nom}	V	400
Mains voltage, single-phase	U_{LN}	V	Not permitted
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not permitted
Tolerance U_{LN}		%	+10 / -15
Minimum inductance of mains supply (mains phase inductance)[1)]	L_{min}	µH	40
Assigned mains choke type			XNL1-1E-0362-N0080-B-500-NNNN-NN
Inrush current	$I_{L\_trans\_max\_on}$	A	tbd
Maximum allowed ON-OFF cycles per minute			20

Designation	Symbol	Unit	XCS*-W0070
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)[2)]	I_{LN}	A	26
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)[3)]	I_{LN}	A	34.6
Mains fuse according to EN 60204-1 (three-phase, without mains choke)		A	32
Mains fuse according to EN 60204-1 (three-phase, with mains choke)		A	50
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	4
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)	S_{LN}	kVA	18
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)	S_{LN}	kVA	23.9

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire with PVC insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

Integrated braking resistor

Table 64: Integrated braking resistor data

Designation	Symbol	Unit	XCS*-W0070
Nominal resistance	$R_{DC\_Bleeder\_nom}$	ohm	14.2
Braking resistor continuous power	P_{BD}	W	410
Braking resistor peak power	P_{BS}	kW	41.2
Absorbable regenerative power	W_{R_max}	kWs	13
Switch-on threshold of braking resistor	$U_{R\_DC\_On\_f}$	V	820

External braking resistor/integrated braking transistor

Table 65: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0070
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	13
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	760
Braking transistor continuous power	P_{BD}	kW	10.3
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000

7.5.13 Electrical data of single-axis converter XCS*-W0100

Control voltage

Table 66: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0100
Control voltage input[1)]	U_{N3}	V	24 ±20%
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4
Pulse width of I_{EIN3}	$t_{EIN3Load}$	ms	20
Input capacitance	C_{N3}	mF	1.7
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	35.6

1) 2) 3) Comply with supply voltage for motor holding brake

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

Mains voltage

Table 67: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0100
Mains frequency	f_{LN}	Hz	50 ... 60
Tolerance mains frequency		Hz	±2
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2
Rotating field condition			None
Short-circuit current rating	SCCR	A rms	42000
Nominal mains voltage	U_{LN_nom}	V	400
Mains voltage, single-phase	U_{LN}	V	Not permitted
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not permitted
Tolerance U_{LN}		%	+10 / -15
Minimum inductance of mains supply (mains phase inductance)[1)]	L_{min}	µH	40
Assigned mains choke type			XNL1-1E-0362-N0080-B-500-NNNN-NN
Inrush current	$I_{L\_trans\_max\_on}$	A	tbd
Maximum allowed ON-OFF cycles per minute			20

Designation	Symbol	Unit	XCS*-W0100
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)[2)]	I_{LN}	A	46.1
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)[3)]	I_{LN}	A	59.5
Mains fuse according to EN 60204-1 (three-phase, without mains choke)		A	50
Mains fuse according to EN 60204-1 (three-phase, with mains choke)		A	63
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	4
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)	S_{LN}	kVA	32
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)	S_{LN}	kVA	41.2

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire with PVC insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

External braking resistor/integrated braking transistor

Table 68: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0100
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	8.4
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	150
Braking transistor continuous power	P_{BD}	kW	7
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000

7.5.14 Electrical data of single-axis converter XCS*-W0120

Control voltage

Table 69: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0120
Control voltage input[1)]	U_{N3}	V	24 ±20%
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4
Pulse width of I_{EIN3}	$t_{EIN3Load}$	ms	20
Input capacitance	C_{N3}	mF	1.7
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	35.6

1) 2) 3) Comply with supply voltage for motor holding brake

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

Mains voltage

Table 70: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0120
Mains frequency	f_{LN}	Hz	50 ... 60
Tolerance mains frequency		Hz	±2
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2
Rotating field condition			None
Short-circuit current rating	SCCR	A rms	42000
Nominal mains voltage	U_{LN_nom}	V	400
Mains voltage, single-phase	U_{LN}	V	Not permitted
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not permitted
Tolerance U_{LN}		%	+10 / -15
Minimum inductance of mains supply (mains phase inductance)[1)]	L_{min}	µH	40
Assigned mains choke type			XNL1-1E-0362-N0080-B-500-NNNN-NN
Inrush current	$I_{L\_trans\_max\_on}$	A	tbd
Maximum allowed ON-OFF cycles per minute			20

Designation	Symbol	Unit	XCS*-W0120
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)[2)]	I_{LN}	A	51
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)[3)]	I_{LN}	A	79.3
Mains fuse according to EN 60204-1 (three-phase, without mains choke)		A	63
Mains fuse according to EN 60204-1 (three-phase, with mains choke)		A	100
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	tbd
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)	S_{LN}	kVA	35.3
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)	S_{LN}	kVA	54.9

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire with PVC insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

External braking resistor/integrated braking transistor

Table 71: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0120
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	8.4
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	150
Braking transistor continuous power	P_{BD}	kW	7
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000

7.5.15 Electrical data of single-axis converter XCS*-W0150

Control voltage

Table 72: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0150
Control voltage input[1)]	U_{N3}	V	24 ±20%
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4
Pulse width of I_{EIN3}	$t_{EIN3Load}$	ms	20
Input capacitance	C_{N3}	mF	1.7
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	61

1) 2) 3) Comply with supply voltage for motor holding brake

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

Mains voltage

Table 73: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0150
Mains frequency	f_{LN}	Hz	50 ... 60
Tolerance mains frequency		Hz	±2
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2
Rotating field condition			None
Short-circuit current rating	SCCR	A rms	42000
Nominal mains voltage	U_{LN_nom}	V	400
Mains voltage, single-phase	U_{LN}	V	Not permitted
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not permitted
Tolerance U_{LN}		%	+10 / -15
Minimum inductance of mains supply (mains phase inductance)[1)]	L_{min}	µH	40
Assigned mains choke type			XNL1-1E-0170-N0146-B-500-NNNN-NN
Inrush current	$I_{L\_trans\_max\_on}$	A	tbd
Maximum allowed ON-OFF cycles per minute			20

Designation	Symbol	Unit	XCS*-W0150
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)[2)]	I_{LN}	A	56
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)[3)]	I_{LN}	A	101
Mains fuse according to EN 60204-1 (three-phase, without mains choke)		A	100
Mains fuse according to EN 60204-1 (three-phase, with mains choke)		A	100
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	tbd
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)	S_{LN}	kVA	38.7
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)	S_{LN}	kVA	68.9

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire with PVC insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

External braking resistor/integrated braking transistor

Table 74: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0150
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	6.7
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	150
Braking transistor continuous power	P_{BD}	kW	29.45
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000

7.5.16 Electrical data of single-axis converter XCS*-W0180

Control voltage

Table 75: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0180
Control voltage input[1)]	U_{N3}	V	24 ±20%
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4
Pulse width of I_{EIN3}	$t_{EIN3Load}$	ms	20
Input capacitance	C_{N3}	mF	1.7
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	75

1) 2) 3) Comply with supply voltage for motor holding brake

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

Mains voltage

Table 76: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0180
Mains frequency	f_{LN}	Hz	50 ... 60
Tolerance mains frequency		Hz	±2
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2
Rotating field condition			None
Short-circuit current rating	SCCR	A rms	42000
Nominal mains voltage	U_{LN_nom}	V	400
Mains voltage, single-phase	U_{LN}	V	Not permitted
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not permitted
Tolerance U_{LN}		%	+10 / -15
Minimum inductance of mains supply (mains phase inductance)[1)]	L_{min}	µH	40
Assigned mains choke type			XNL1-1E-0170-N0146-B-500-NNNN-NN
Inrush current	$I_{L\_trans\_max\_on}$	A	tbd
Maximum allowed ON-OFF cycles per minute			20

Designation	Symbol	Unit	XCS*-W0180
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)[2)]	I_{LN}	A	70
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)[3)]	I_{LN}	A	117
Mains fuse according to EN 60204-1 (three-phase, without mains choke)		A	100
Mains fuse according to EN 60204-1 (three-phase, with mains choke)		A	100
required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	tbd
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)	S_{LN}	kVA	49
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)	S_{LN}	kVA	81

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire with PVC insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

External braking resistor/integrated braking transistor

Table 77: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0180
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	5.6
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	150
Braking transistor continuous power	P_{BD}	kW	35.5
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	2000

7.5.17 Electrical data of single-axis converter XCS*-W0210

Control voltage

Table 78: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0210
Control voltage input[1)]	U_{N3}	V	24 ±20%
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4
Pulse width of I_{EIN3}	$t_{EIN3Load}$	ms	20
Input capacitance	C_{N3}	mF	1.7
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	71.5

1) 2) 3) Comply with supply voltage for motor holding brake

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

Mains voltage

Table 79: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0210
Mains frequency	f_{LN}	Hz	50 ... 60
Tolerance mains frequency		Hz	±2
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2
Rotating field condition			None
Short-circuit current rating	SCCR	A rms	42000
Nominal mains voltage	U_{LN_nom}	V	400
Mains voltage, single-phase	U_{LN}	V	Not permitted
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not permitted
Tolerance U_{LN}		%	+10 / -15
Minimum inductance of mains supply (mains phase inductance)[1)]	L_{min}	µH	40
Assigned mains choke type			XNL1-1E-0170-N0146-B-500-NNNN-NN
Inrush current	$I_{L\_trans\_max\_on}$	A	tbd
Maximum allowed ON-OFF cycles per minute			20

Designation	Symbol	Unit	XCS*-W0210
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)[2)]	I_{LN}	A	117.5
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)[3)]	I_{LN}	A	139.9
Mains fuse according to EN 60204-1 (three-phase, without mains choke)		A	160
Mains fuse according to EN 60204-1 (three-phase, with mains choke)		A	160
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	2/0
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)	S_{LN}	kVA	84.4
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)	S_{LN}	kVA	96.9

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire with PVC insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

External braking resistor/integrated braking transistor

Table 80: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0210
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	4
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	75
Braking transistor continuous power	P_{BD}	kW	30
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	5000

7.5.18 Electrical data of single-axis converter XCS*-W0250

Control voltage

Table 81: Control voltage supply data

Designation	Symbol	Unit	XCS*-W0250
Control voltage input[1)]	U_{N3}	V	24 ±20%
Control voltage when using motor holding brake with motor cable length < 50 m[2)]	U_{N3}	V	24 ±5%
Control voltage when using motor holding brake with motor cable length > 50 m[3)]	U_{N3}	V	26 ±5%
Max. inrush current at 24 V supply	I_{EIN3_max}	A	4
Pulse width of I_{EIN3}	$t_{EIN3Load}$	ms	20
Input capacitance	C_{N3}	mF	1.7
Maximum power consumption control voltage input at U_{N3}	P_{N3}	W	71.5

1) 2) 3) Comply with supply voltage for motor holding brake

Overvoltage

Overvoltage greater than 33 V has to be discharged by the appropriate electrical equipment of the machine or installation.

Electrical equipment affected:

- 24V power supply units that reduce incoming overvoltage to the allowed value.
- Overvoltage protector at the control cabinet input, limiting overvoltage to the permissible value. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

Mains voltage

Table 82: Mains voltage supply data

Designation	Symbol	Unit	XCS*-W0250
Mains frequency	f_{LN}	Hz	50 ... 60
Tolerance mains frequency		Hz	±2
Maximum allowed mains frequency change	$\Delta f_{LN}/\Delta t$	Hz/s	2
Rotating field condition			None
Short-circuit current rating	SCCR	A rms	42000
Nominal mains voltage	U_{LN_nom}	V	400
Mains voltage, single-phase	U_{LN}	V	Not permitted
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at IT mains	U_{LN}	V	200 ... 500
Mains voltage, three-phase at Corner-grounded-Delta mains	U_{LN}	V	Not permitted
Tolerance U_{LN}		%	+10 / -15
Minimum inductance of mains supply (mains phase inductance)[1)]	L_{min}	µH	40
Assigned mains choke type			XNL1-1E-0170-N0146-B-500-NNNN-NN
Inrush current	$I_{L\_trans\_max\_on}$	A	tbd
Maximum allowed ON-OFF cycles per minute			20

Designation	Symbol	Unit	XCS*-W0250
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)[2)]	I_{LN}	A	141.5
Mains input continuous current at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)[3)]	I_{LN}	A	160.8
Mains fuse according to EN 60204-1 (three-phase, without mains choke)		A	200
Mains fuse according to EN 60204-1 (three-phase, with mains choke)		A	200
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	tbd
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, without mains choke)	S_{LN}	kVA	98
Mains connected load at U_{LN_nom} and P_{DC_cont} (three-phase, with mains choke)	S_{LN}	kVA	111.4

1) Otherwise, use XNL mains choke

2) 3) Find interim values by interpolation

4) Copper wire with PVC insulation (conductor temperature 90 °C; Ta ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

External braking resistor/integrated braking transistor

Table 83: Minimum requirement on external braking resistor/integrated braking transistor

Designation	Symbol	Unit	XCS*-W0250
Minimum resistance	$R_{DC\_Bleeder\_min}$	ohm	4
Maximum resistance	$R_{DC\_Bleeder\_max}$	ohm	75
Braking transistor continuous power	P_{BD}	kW	30
Absorbable regenerative power of braking transistor	W_{R_max}	kWs	5000

7.5.19 Required electric strength of connected cables

- Lines at connection points XD01, XD02, XD03, XD04, XD10, XG03, XZ03:
  - Dielectric strength to basic insulation
  - Operating voltage designed for mains voltage and DC bus voltage (conductor/conductor: 500 VAC, conductor/ground: 300 VAC)
- Lines at connection points XG and XF:
  - Operating voltage of the corresponding control signal or communication signal
  - Lines run on the left or right side of the device have to be run at a minimum distance of $d_{hor} \geq 10$ mm to the device.

    If this distance is less than the minimum distance, these lines must have been designed for the mains voltage and DC bus voltage.

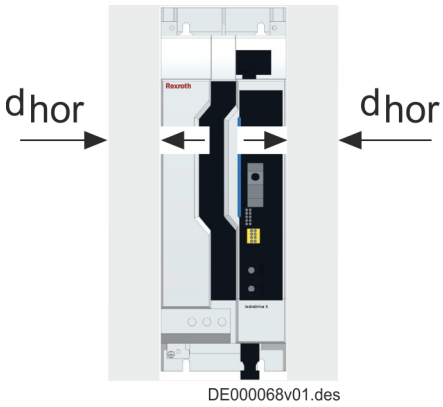
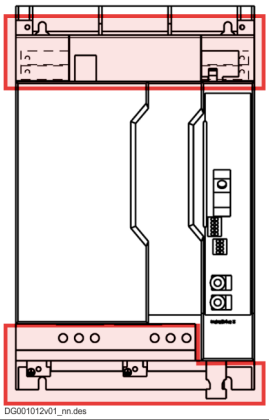
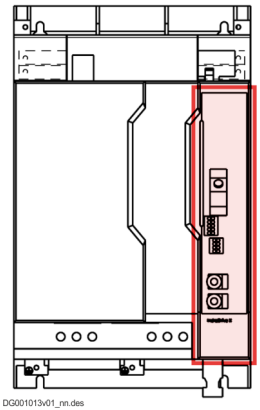


Fig. 45: d_{hor}: Lateral distance

7.5.20 Connection points power section/control section

Power section (example XCS)	Control section (example XCS)
	

7.5.21 XCS, connection points

Table 84: XCS*-W0023

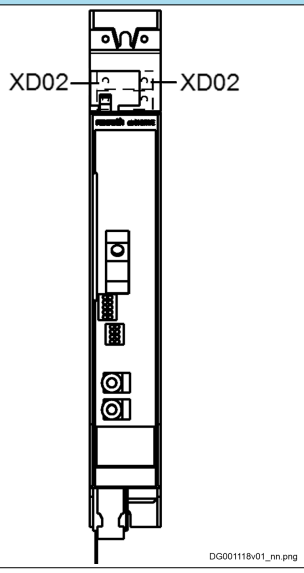
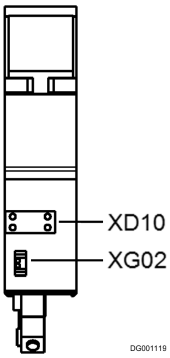
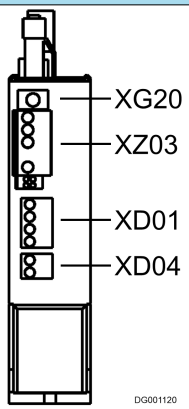
Front	Top	Bottom
		
XD02: DC bus	XD10: Control voltage XG02: Ready-for-operation relay contact	XD01: Mains connection XD04: External braking resistor XG20: Digital encoder connection XZ03: Motor connection + motor temperature monitoring and motor holding brake

Table 85: XCS*-W0054/70

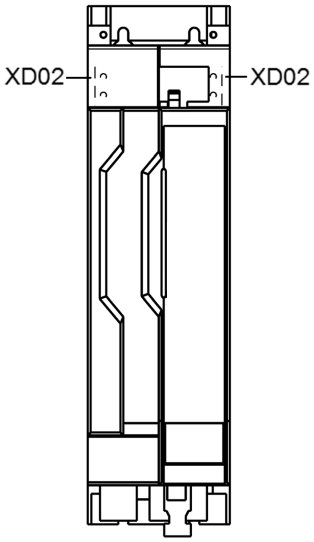
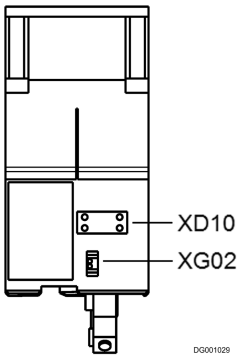
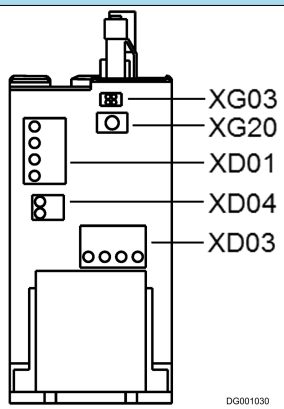
Front	Top	Bottom
		
XD02: DC bus	XD10: Control voltage XG02: Ready-for-operation relay contact	XD01: Mains connection XD03: Motor connection XD04: External braking resistor XG03: Motor temperature monitoring and motor holding brake XG20: Digital encoder connection

Table 86: XCS*-W01xx

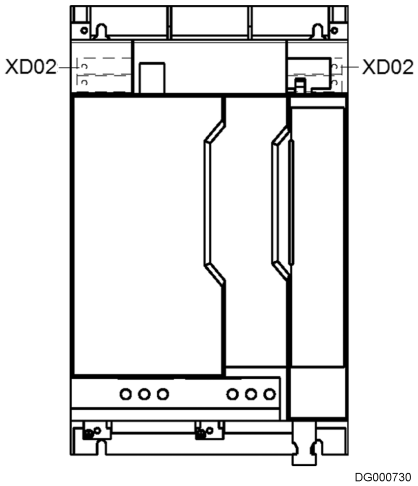
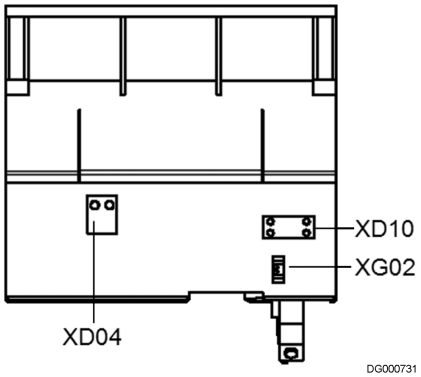
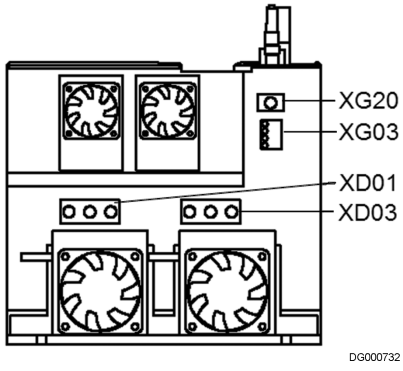
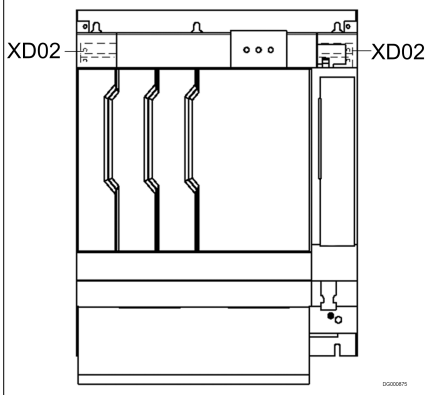
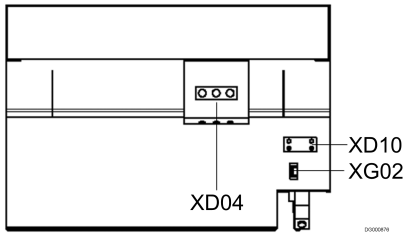
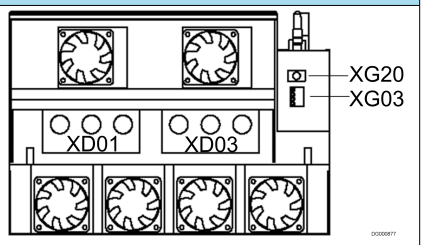
Front	Top	Bottom
		
XD02: DC bus	XD10: Control voltage XG02: Ready-for-operation relay contact	XD01: Mains connection XD03: Motor connection XD04: External braking resistor XG03: Motor temperature monitoring and motor holding brake XG20: Digital encoder connection

Table 87: XCS*-W02xx

Front	Top	Bottom
		
XD02: DC bus	XD10: Control voltage XG02: Ready-for-operation relay contact	XD01: Mains connection XD03: Motor connection XD04: External braking resistor XG03: Motor temperature monitoring and motor holding brake XG20: Digital encoder connection

7.5.22 Connection points of control section

Control section types

Control sections are not stand-alone products, but integrated parts of the drive controllers and supply units.

Type code

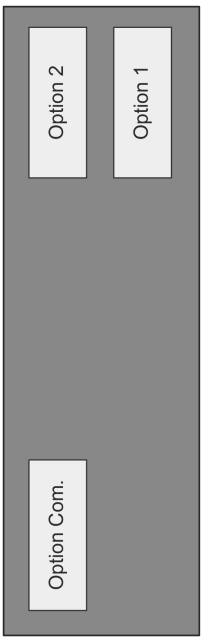
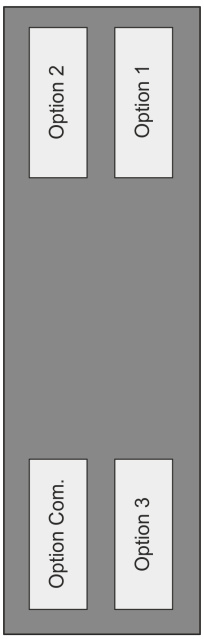
The type code positions 15 ... 25 define the control sections.

Table 88: Type code (control section)

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	X	C	S	2	-	W	0	0	5	4	A	B	N	-	0	1	N	E	T	T	0	E	C	N	N	-	S	0	1	R	S	N	2	N	N	N	2	D	N	N
															⑦		⑧	⑨		⑩		⑪		⑫																	
⑦	**Control section design:** 01 = ctrlX DRIVE 02 = ctrlX DRIVE plus																																							
⑧	**Control panel:** N = Without A = With control panel																																							
⑨	**Communication option:** ET = Multi-Ethernet with RJ45 X3 = ctrlX CORE																																							
⑩	**Option 1 (safety technology):** T0 = Safe Torque Off (STO) M5 = SafeMotion (M5)																																							
⑪	**Option 2:** EC = Multi-encoder interface NN = Not equipped																																							
⑫	**Option 3:** ET = Multi-Ethernet DA = Digital/analog I/O extension NN = Not equipped																																							

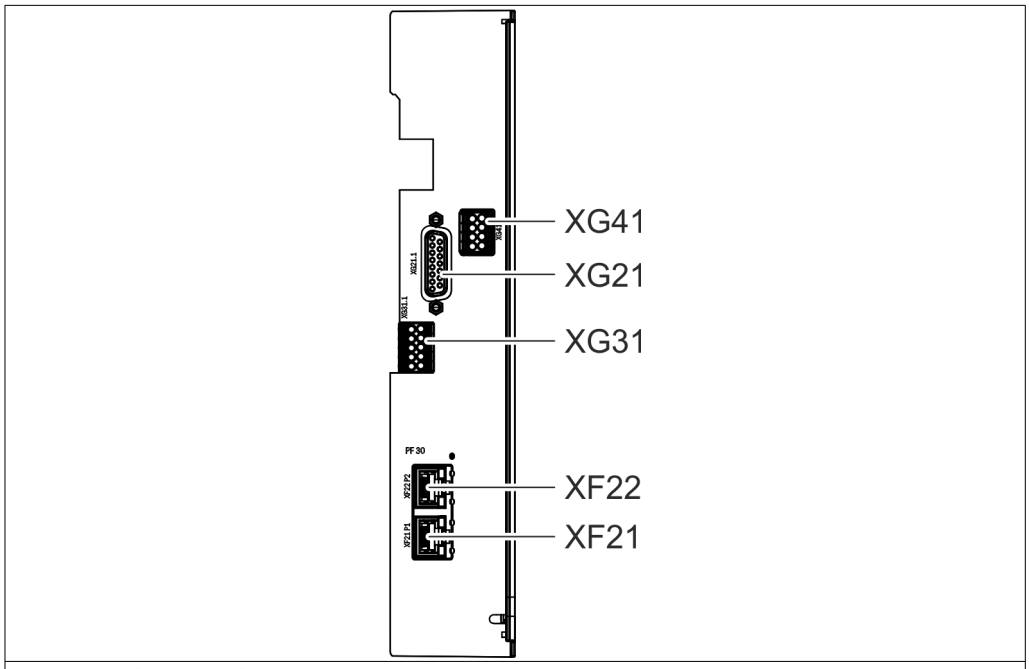
Single-axis (XCS)

Table 89: Single-axis

Example: XCS with ctrlX DRIVEplus + ctrlX CORE			ctrlX DRIVE	ctrlX DRIVE plus
				
XCS	Option 1: (safety technology)	T0 = Safe Torque Off (STO)	✓	✓
		M5 = SafeMotion (M5)	-	✓
	Option 2	EC = Multi-encoder interface	✓	✓
		NN = Not equipped	✓	✓
	Option 3	ET = Multi-Ethernet	-	-
		DA = Digital/analog I/O extension	-	✓
		NN = Not equipped	✓	✓
	Option Com.	ET = Multi-Ethernet	✓	✓
		X3 = ctrlX CORE	-	-

ctrlX DRIVE single-axis

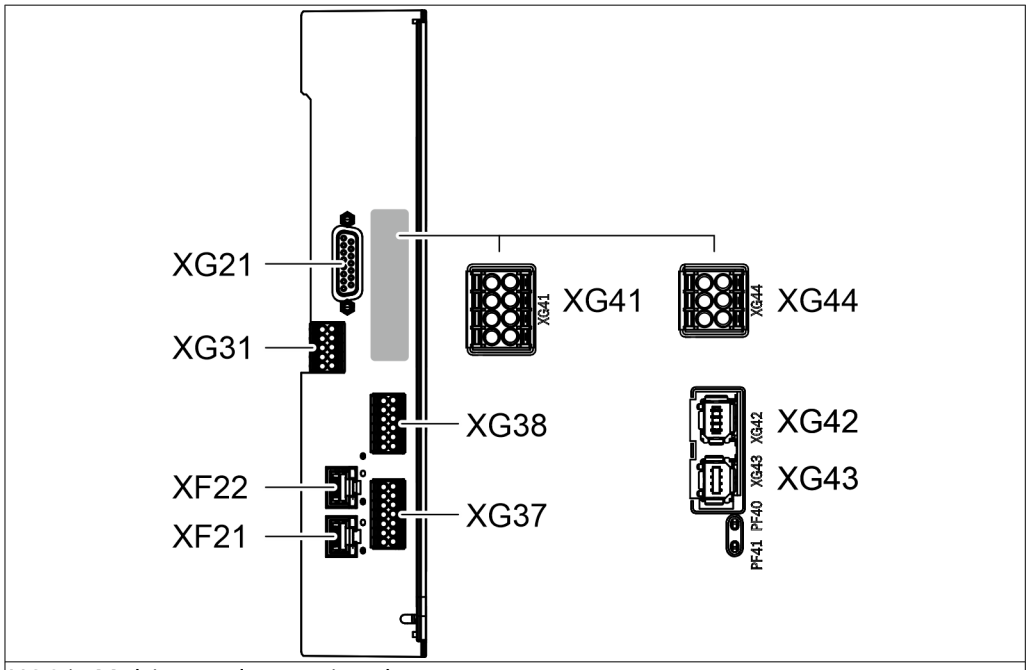
Table 90: Connection points



XG21: Multi-encoder
XG31: Digital inputs/outputs, analog inputs
XG41: Safety technology (Safe Torque Off)
XF21, XF22: Communication

ctrlX DRIVEplus single-axis

Table 91: Connection points



XG21: Multi-encoder; optional
XG31: Digital inputs/outputs, analog inputs
XG41: Safety technology (Safe Torque Off); optional
XG42, XG43, XG44: Safety technology (SafeMotion M5); optional
XF21, XF22: Communication

7.5.23 On-board connection points

Equipment grounding conductor

⚠ WARNING	**High housing voltage and high leakage current!** Danger to life, risk of injury by electric shock! – Prior to switching on and commissioning, ground or connect the electric drive and control system components to the equipment grounding conductor at the grounding points. – Connect the equipment grounding conductor of the electric drive and control system components permanently to the main power supply at all times. The leakage current is greater than 3.5 mA. – Establish an equipment grounding connection with a copper wire of a cross-section of at least 10 mm^2 or additionally run a second equipment grounding conductor of the same cross-section as the original equipment grounding conductor.

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V!** Fatal electric shock! Replace the device exclusively – with plugged connectors (even if no cables are connected to the connectors) and – with connected grounding conductor!

Equipment grounding conductor: Material and cross-section

Use the same metal (e.g., copper) for the equipment grounding conductor as for the outer conductors.

Ensure a sufficient cross-section of the cables for connections from the equipment grounding conductor connection point of the device to the grounding conductor system in the control cabinet.

Cross-section of the grounding conductor connections: For drive controllers **Xxxn-Wxnnn at least 10 mm^2**, but not smaller than the cross-section of the outer conductor of the supply feeder.

Additionally, mount the housing on a bare metal mounting plate. Connect the mounting plate also to the equipment grounding system in the control cabinet using at least the same cross-section.

M5 (housing)

Connect ring cable lugs **M5** of equipment grounding conductors to the device housing (⏚ symbol).

Tightening torque: 2.8 Nm

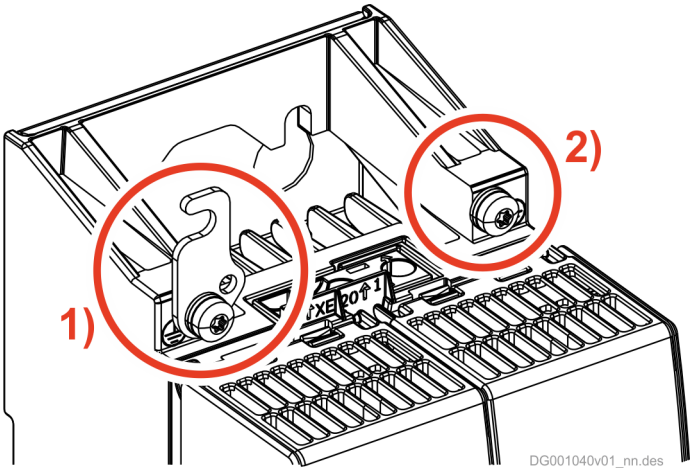


Fig. 46: Connection points of grounding conductor

1) Equipment grounding conductor connection point with swivel hook for connection with neighboring device
2) Connection of equipment grounding conductor

XCS*-W0100/120

Connect ring cable lugs **M5** of equipment grounding conductors to the device housing (⏚ symbol).

Tightening torque: 4.5 Nm

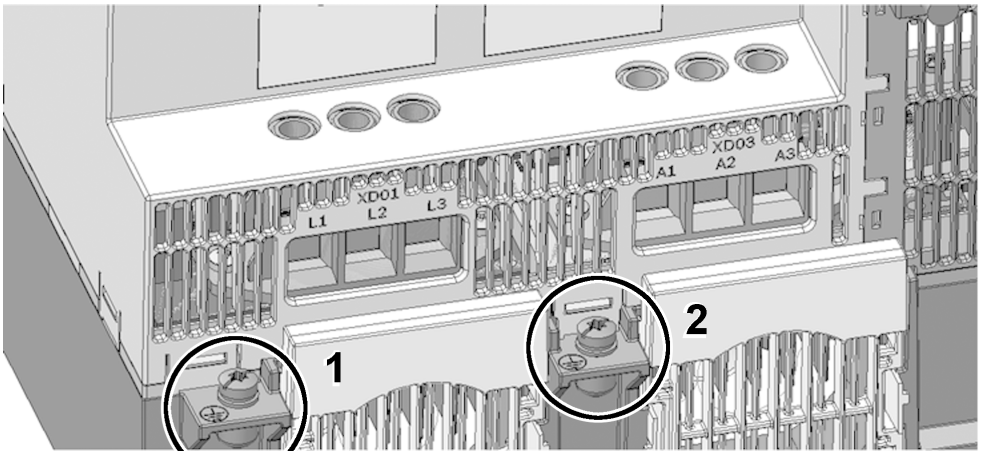


Fig. 47: Connection points of grounding conductor

1 Mains
2 Motor

XCS*-W02xx

Connect ring cable lugs **M8** of equipment grounding conductors to the device housing (⏚ symbol).

Tightening torque: 8 Nm

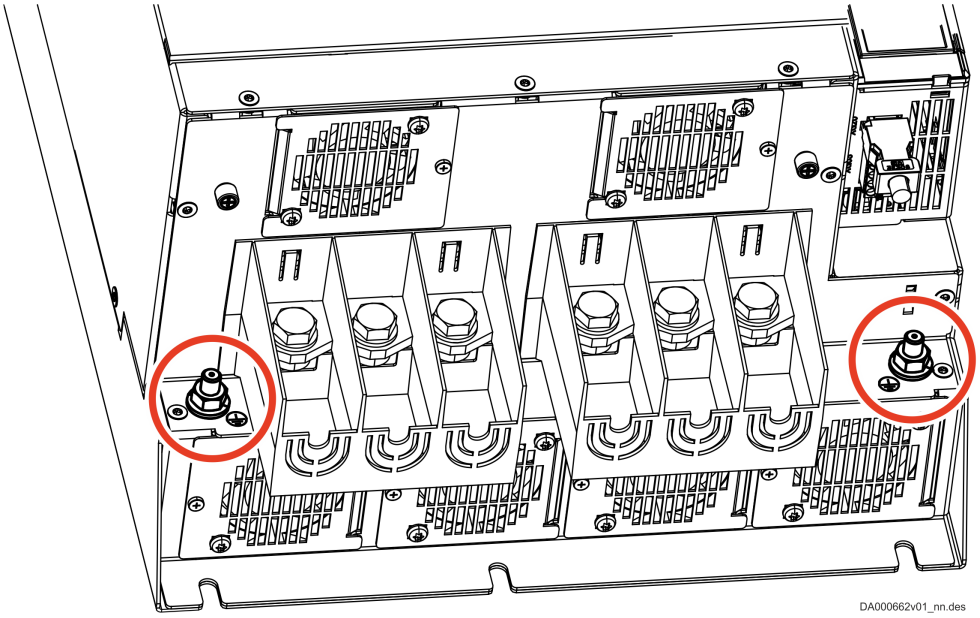


Fig. 48: Connection point of equipment grounding conductor (XCS*-W02xx)

XCS*-W0150/180

Connect ring cable lugs **M6** of equipment grounding conductors to the device housing (⏚ symbol).

Tightening torque: 4 ... 5 Nm

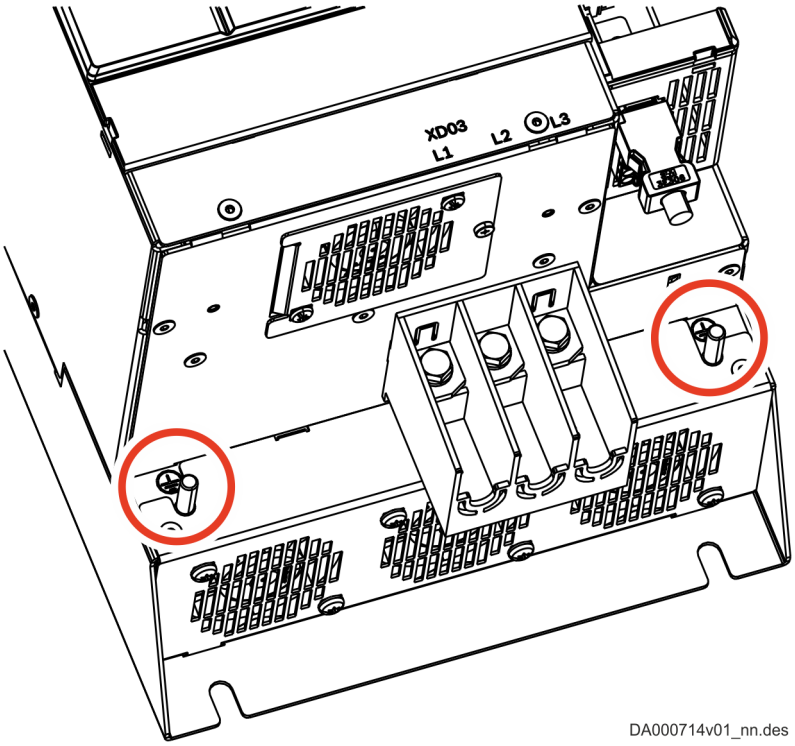


Fig. 49: Connection point of equipment grounding conductor (XVR*-W0048, for example)

7.5.24 Connection points of the components

XD01: Mains connection

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V!** Fatal electric shock! Replace the device exclusively – with plugged connectors (even if no cables are connected to the connectors) and – with connected grounding conductor!
NOTICE	**Cables routed under stress!** Risk of damage to the device! – Provide for strain relief of the connection terminals of the device in the control cabinet.

The connector is included in the scope of delivery

Overview

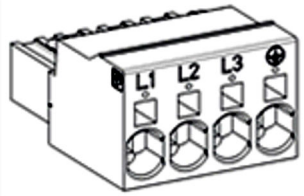
There are different types of connections:

- Screw connection at device (⊘).
- Screw connection at connector (—⊘(▬—).
- Spring terminal at connector (—⇒(▬—).

Component	PE + XD01 L1 L2 L3	XD01 L1 L2 L3	XD01 L1 L2 L3
XCS	W0100, W0120: 35 mm² W0150, W0180: 50 mm² W02xx: 120 mm²	W0054, W0070: 16 mm²	W0023: 10 mm²

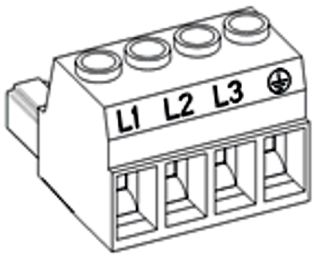
XD01, mains connection (10 mm²)

Table 92: Function, pinout, properties

View	Identification	Function	
	L1	Connection to power grid (L1)	
	L2	Connection to power grid (L2)	
	L3	Connection to power grid (L3)	
	⏚	Connection of equipment grounding conductor	
Spring terminal (connector)	**Unit**	**Min.**	**Max.**
Connection cable	mm²	0.2	6.0
stranded wire	AWG	24	10
Connection cable	mm²	0.2	10.0
single-wire	AWG	24	8
Stripped length	mm	15	
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

XD01, mains connection (16 mm²)

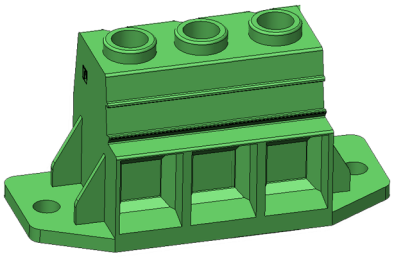
Table 93: Function, pinout, properties

View	Marking	Function	
	L1	Connection to power grid (L1)	
	L2	Connection to power grid (L2)	
	L3	Connection to power grid (L3)	
	⏚	Connection of equipment grounding conductor	
Screw connection at connector	**Unit**	**min.**	**max.**
Connection cable	mm²	6.0	16.0
stranded wire	AWG	10	6
Stripped length	mm	12	
Tightening torque	Nm	1.2	1.5

Occurring current load and minimum required connection cross section		see technical data of device used (I_{LN} and A_{LN})
Occurring voltage load		see technical data of device used (U_{LN} or U_{LN_nom})

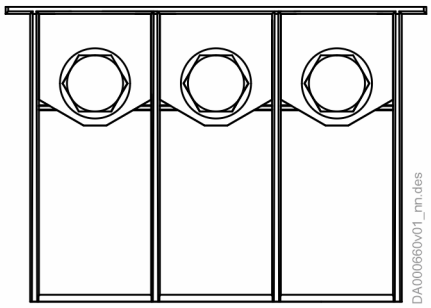
XD01, mains connection (35 mm²)

Table 94: Function, pinout, properties

View	Marking	Function	
	L1	Connection to power grid (L1)	
	L2	Connection to power grid (L2)	
	L3	Connection to power grid (L3)	
Terminal block	**Unit**	**min.**	**max.**
Connection cable	mm²	0.5	35
stranded wire	AWG	20	2
Stripped length	mm	18	
Tightening torque (≤ 25 mm²)	Nm	2.5	
Tightening torque (≥ 25 mm²)	Nm	4.5	
Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})	

XD01, mains connection (50 mm²)

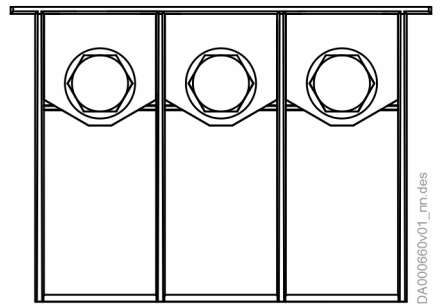
Table 95: Function, pinout, properties

View	Identifi-cation	Function	
	L1	Connection to power grid (L1)	
	L2	Connection to power grid (L2)	
	L3	Connection to power grid (L3)	
Terminal block	**Unit**	**min.**	**max.**
Screw thread		M6	
Tightening torque	Nm	4	5
Connection cable	mm²	1×50	
stranded wire		2×25	
	AWG	1×1/0	

Occurring current load and minimum required connection cross section		See technical data of device used (I_{LN} and A_{LN})
Occurring voltage load		See technical data of device used (U_{LN} or U_{LN_nom})

XD01, mains connection (120 mm²)

Table 96: Function, pinout, properties

View	Identification	Function
	L1	Connection to power grid (L1)
	L2	Connection to power grid (L2)
	L3	Connection to power grid (L3)

Terminal block	Unit	min.	max.
Connection cable	mm²	1×16, 2×16	1×120, 2×120
stranded wire	AWG	1×6, 2×4	1×4/0, 2×4/0
Thread		M10	
Tightening torque	Nm	16	20
Occurring current load and minimum required connection cross section		see technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		see technical data of device used (U_{LN} or U_{LN_nom})	

XD02, L+ L-, DC bus connection

Function, pinout

The DC bus connection connects

- multiple drive controllers to one another
- one drive controller to a DC bus capacitor unit (to backup the DC bus voltage)

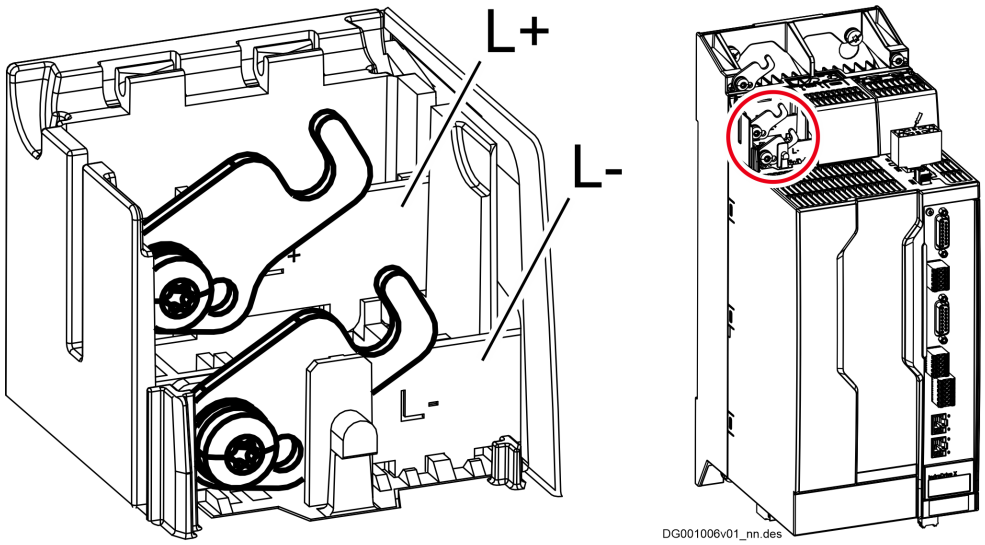


Fig. 50: Swivel hooks for DC bus connection

Tightening torque 2.8 Nm

Short-circuit protection	By fusing elements in the incoming circuit of the mains connection
Overload protection	
Current carrying capacity	≤ W0120: 120 A ≥ W0150: 300 A

Touch guard

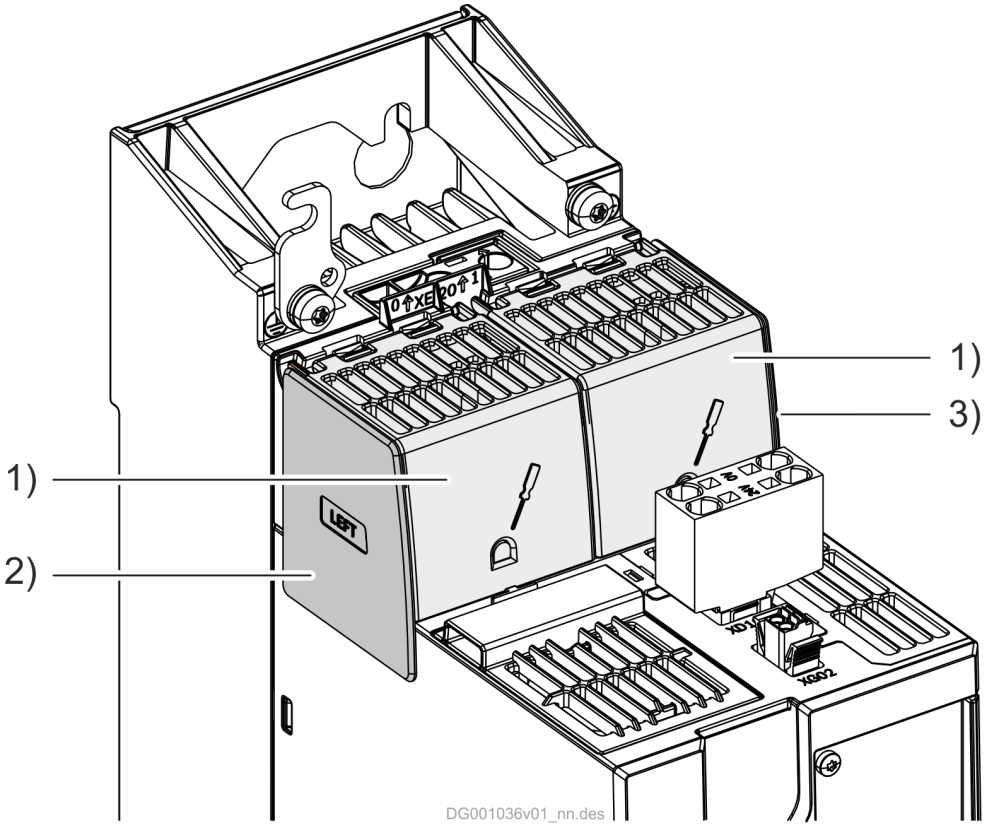


Fig. 51: Touch guard
1) Touch guard flap
2) Touch guard plate (LEFT; R911400453)
3) Touch guard plate (RIGHT; R911400452)

As a standard, the devices are supplied with a touch guard.

The touch guard plate may only be removed to connect the DC buses of neighboring devices.

Dismounting the touch guard

1. Unlock and open the touch guard flap.
2. Move the touch guard plate vertically upwards and remove it.

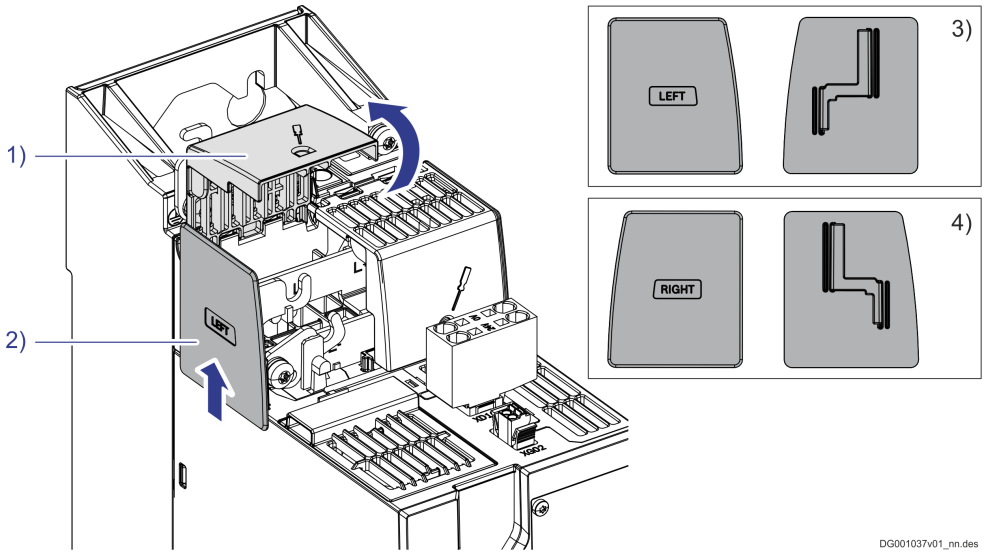
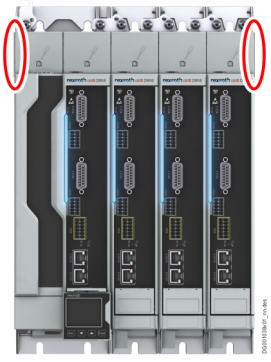


Fig. 52: Touch guard
1) Touch guard flap
2) Touch guard plate
3) Touch guard plate left (front side and back side)
4) Touch guard plate right (front side and back side)

Axis group

If multiple devices are mounted side by side in the axis group:

1. Before mounting the devices: Remove all unnecessary touch guard plates.
2. After mounting the devices: Make sure the touch guard plates have been fitted at the first and last device.



DC bus coupling of multiple devices

See chapter “DC bus coupling” in document R911386579.

XD03: Motor connection

Installation instructions

The specified connection cross sections are the cross sections that can be connected. Size the **required cross-section** of the connection lines according to the occurring current load.

- Provide for optimum shield contact of the motor power cable.
- For the connection between drive controller and motor, use our ready-made motor power cables, where possible.

Motor connection overview

There are different types of connections:

- Screw connection at device (⊘).
- Screw connection at connector (—⊘(▬—).
- Spring terminal at connector (—⊃(▬—).

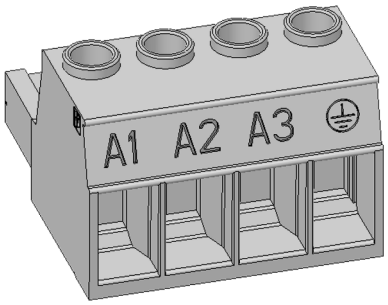
The table below gives an overview of motor connections including the hybrid connection XZ03.

Table 97: Motor connection: Overview

Component	PE + XD03 ⏚ A1 A2 A3	XD03 A1 A2 A3 ⏚	XZ03 A1 A2 A3 ⏚ 0VBr +24VBr MotTemp- MotTemp+
XCS	1× W0100, W0120: 35 mm² W0150, W0180: 50 mm² W02xx: 120 mm²	1× W0054, W0070: 10 mm² W0090: 16 mm²	1× W0023: 10 mm²
PE + XD03 Screw connection at device XD03: Screw connection at connector XZ03: Spring terminal at connector 1) See chapter “XZ03, Hybrid connection (motor, motor temperature monitoring and motor holding brake)” in document R911386579.			

XD03, motor connection (10 mm²)

Table 98: Function, pinout, properties

View	Marking	Function
	A1	For power connection U1 at motor
	A2	For power connection V1 at motor
	A3	For power connection W1 at motor
	⏚	For equipment grounding connection at motor

Screw connection at connector	Unit	min.	max.
Connection cable	mm²	0.75	10.0
stranded wire	AWG	18	8
Stripped length	mm	14	
Tightening torque	Nm	1.5	1.8

Occurring current load and minimum required connection cross section	A	see technical data of device used (I_{OUT})
Occurring voltage load	V	see technical data of device used (U_{OUT})
Short-circuit protection		A1, A2, A3 against each other and each of them against ground

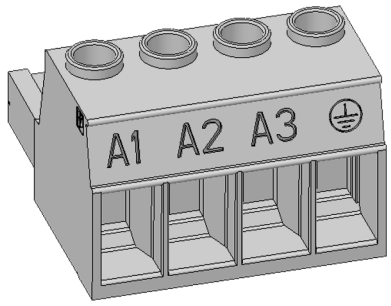
Accessories, shield connection:

- XCS*-W0054/70: XAS2-006-003-NN

Typical motor cable cross section: 1 × 6 mm:²

XD03, motor connection (16 mm²)

Table 99: Function, pin assignment, properties

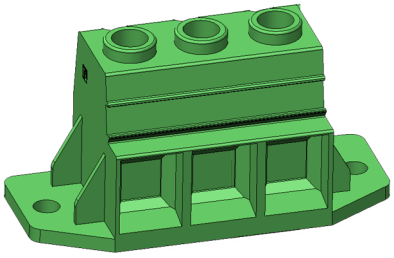
View	Labeling	Function	
	A1	for power connection U1 at motor	
	A2	for power connection V1 at motor	
	A3	for power connection W1 at motor	
	⏚	For equipment grounding connection at motor	
Screw connection at connector	**Unit**	**min.**	**max.** [1]
Connection cables	mm²	0.75	16.0
Stranded wire	AWG	18	6
Wire stripping length	mm	12	
Tightening torque	Nm	1.7	1.8
occurring current load and minimum required connection cross section	A	see technical data of the used device (I_{out})	
occurring stress load	V	see technical data of the used device (U_{out})	
Includes short circuit protection		A1, A2, A3 against each other and each of them against ground	

1) Only wire end ferrule allowed **without** plastic sleeve.

Typical motor cable cross section: 1 × 10 mm:²

XD03, motor connection (35 mm²)

Table 100: Function, pin assignment, properties

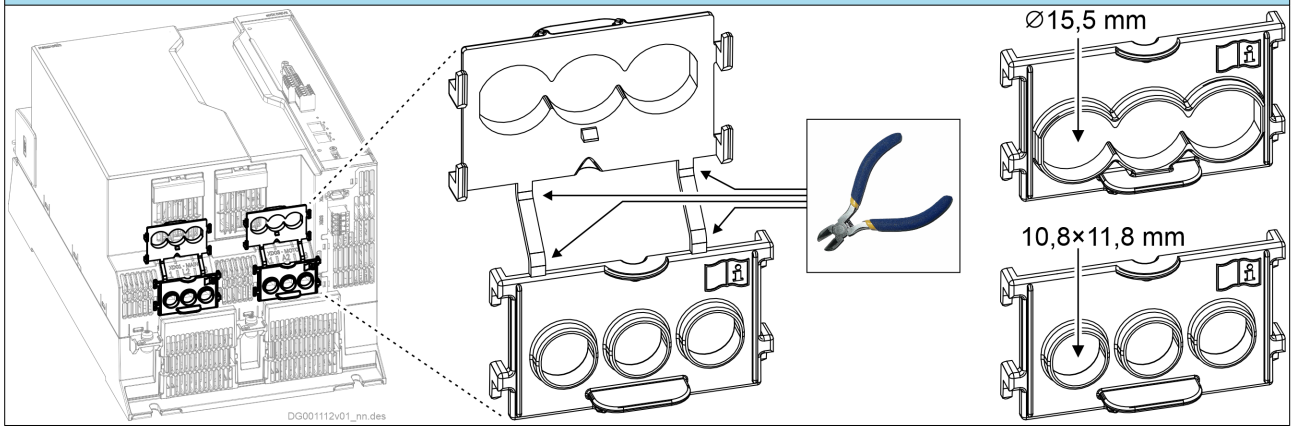
View	Labeling	Function	
	A1	for power connection U1 at motor	
	A2	for power connection V1 at motor	
	A3	for power connection W1 at motor	
Connection block	**Unit**	**min.**	**max.**
Connection cables	mm²	0.5	35

Stranded wire	AWG	20	2
Wire stripping length	mm	18	
Tightening torque (≤ 25 mm²)	Nm	2.5	
Tightening torque (≥ 25 mm²)	Nm	4.5	
occurring current load and minimum required connection cross section	A	see technical data of the used device (I_{out})	
occurring stress load	V	see technical data of the used device (U_{out})	
Includes short circuit protection		A1, A2, A3 against each other and each of them against ground	

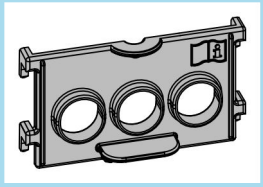
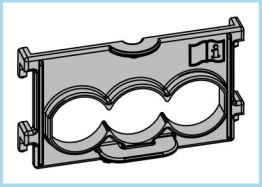
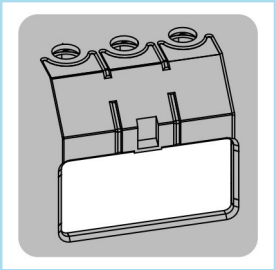
Cable gland 35 mm²

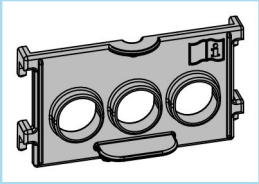
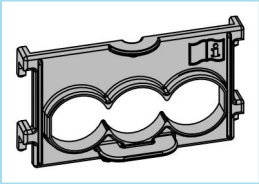
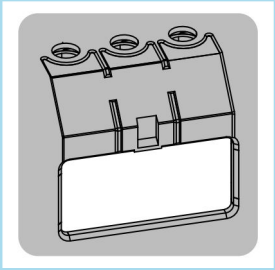
At connection points **35 mm²** a cable feedthrough (R911410689) is fitted to the device.

Cable gland

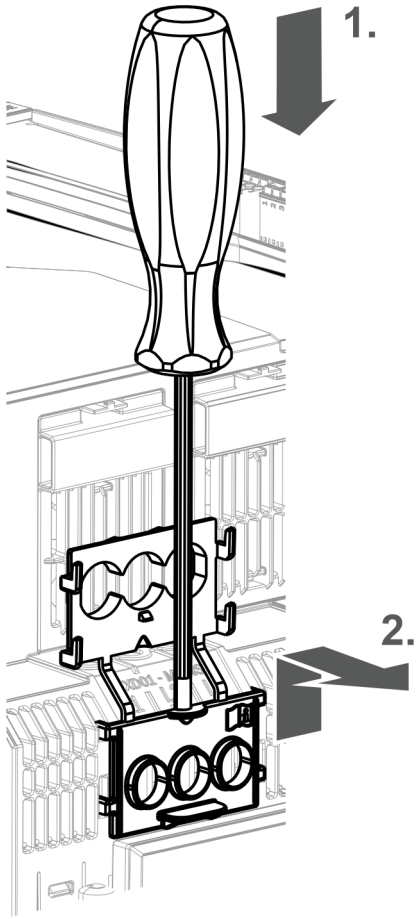


Use

Cable Connection	Opening width [mm]		
	10.8×11.8	Ø15.5	44.1×21.4
			 Device (cable feed-through dismounted)
Ø Cables (outer diameter)	2.5 ... 10.5 mm	10.6 ... 15 mm	-
1 × with/without wire end ferrule	1.5 ... 16 mm² AWG16 ... 6	25 ... 35 mm² AWG4 ... 2	-
2 × with twin wire end ferrule	1.5 ... 4 mm² AWG16 ... 12	6 ... 10 mm² AWG10 ... 8	16 mm² AWG6
2 × without wire end ferrule	1.5 ... 6 mm² AWG16 ... 10	-	-

Use			
Cable Connection	Opening width [mm]		
	10.8×11.8	Ø15.5	44.1×21.4
			 Device (cable feed-through dismounted)
2 × with wire end ferrule (without plastic collar)	1.5 ... 4 mm² AWG16 ... 12	-	-

Instructions for mounting		
Opening width 10.8×11.8 alright	**Opening width Ø15.5 required**	**No cable feedthrough required**
Leave cable feedthrough at the device and remove the unnecessary part of the cable feed-through (e.g., using diagonal cutters).	• Dismount cable feedthrough (dismounting: see below). • Remove unnecessary part of the cable feedthrough (e.g., using diagonal cutters). • Mount cable feedthrough with Ø15,5 opening width.	Dismount cable feedthrough (dismounting: see below).

Demounting	
	• Put screwdriver (**torx T20**) into the opening of the cable feedthrough and carefully push it down as far as possible and keep it pushed. • First move cable feedthrough up and then pull.

Accessories **Shield connection**:

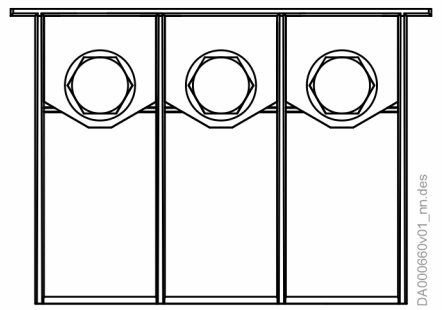
- XCS2-W0100/120: XAS2-002-003-NN

Typical motor cable cross section: 1 × 16 mm:^{2}

Double wiring with 2 × 10 mm^2 is possible using twin wire end ferrule.

XD03, motor connection (50 mm^2)

Table 101: Function, pinout, properties

View	Identification	Function
	A1	For power connection U1 at motor
	A2	For power connection V1 at motor
	A3	For power connection W1 at motor

Terminal block	Unit	min.	max.
Connection cable stranded wire with ring cable lug[1)]	mm^2	1×50 2×25	

	AWG	1×1/0	
Screw thread		M6	
Tightening torque	Nm	4	5
Occurring current load and minimum required connection cross section		see technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		see technical data of device used (U_{LN} or U_{LN_nom})	

1) Maximum allowed length of ring cable lug: 38 mm; insulate ring cable lugs with heat shrink sleeves

Accessories, shield connection:

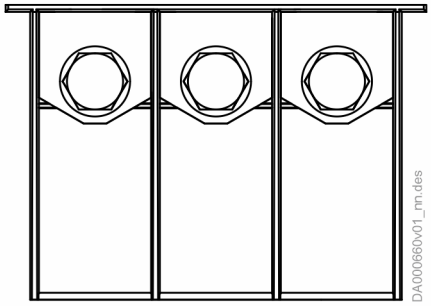
- XCS*-W0150/180:
  - XAS2-007-001-NN
  - XAS2-007-002-NN

Typical motor cable cross section: 1 × 16 mm:^{2}

Double wiring with 2 × 10 mm^2 is possible using twin wire end ferrule.

XD03, motor connection (120 mm2)[2])

Table 102: Function, pinout, properties

View	Identification	Function
	A1	For power connection U1 at motor
	A2	For power connection V1 at motor
	A3	For power connection W1 at motor

Terminal block	Unit	min.	max.
Connection cable	mm^2	1×16, 2×16	1×120, 2×120
stranded wire with ring cable lug[1)]	AWG	1×6, 2×6	1×4/0, 2×4/0
Screw thread		M10	
Tightening torque	Nm	16	20
Occurring current load and minimum required connection cross section		see technical data of device used (I_{LN} and A_{LN})	
Occurring voltage load		see technical data of device used (U_{LN} or U_{LN_nom})	

1) Insulate ring cable lugs with heat shrink sleeves

Accessories, shield connection:

- XCS*-W0210/250/280
  - XAS2-004-001-NN
  - XAS2-004-002-N

Typical motor cable cross section:

- 1 × 50 mm:^{2}
- Double wiring with 2 × 25 mm^2 is possible using twin wire end ferrule.

XD04: External braking resistor

Function

Is used to connect the integrated or external braking resistor **HLR**. The braking resistor is connected to the DC bus using an internal switch.

Installation instructions

⚠ WARNING	**Lethal electric shock from live parts with more than 50 V! Hot housing surfaces!** Risk of fatal electric shock! Risk of burning! Risk of fire! The temperature of the housing surface of an external HLR braking resistor can rise up to 150 °C. Run the connection lines with a sufficient distance (> 200 mm) to the housing of the HLR braking resistor to avoid damaging the insulation of the connection lines. Outside of the control cabinet, run the connection lines of an HLR braking resistor in a metal pipe with a wall thickness of at least 1 mm. Do not touch any hot housing surfaces! Mount the HLR braking resistor on a temperature-resistant mounting surface. Provide a sufficient distance between the HLR braking resistor and heat-sensitive materials. Make sure the cooling air supply is unrestricted. Take care that the environment can discharge the dissipation heat.
NOTICE	**Danger by inadequate installation!** Protect the lines with the appropriate fusing elements in the supply feeder. For the connection lines at XD04, use at least the cross section of the lines for mains connection at XD03. If this is impossible, select the cross section of the connection line at XD04 in accordance with the continuous power of the braking resistor.

Maximum allowed line length to external braking resistor: **5 m**

Twist **unshielded lines**.

Overview

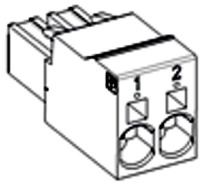
There are different types of connections:

- Screw connection at device (⊘).
- Screw connection at connector (—⊘(▬—).
- Spring terminal at connector (—⊃(▬—).

Component	XD04 PE 2 1	XD04 1 2	XD04 1 2
XCS	W02xx: 35 mm²	W0100, W0120: 16 mm² W0150, W0180: 16 mm²	W0023, W0054, W0070: 10 mm²

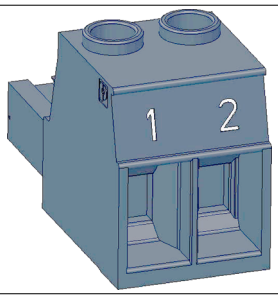
XD04 (10 mm²)

Table 103: Function, pinout, properties

View	Connection	Function	
	1	Braking resistor connection	
	2	Braking resistor connection	
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm²	0.2	6.0
stranded wire	AWG	24	10
Connection cable	mm²	0.2	10.0
single-wire	AWG	24	8
Stripped length	mm	15	

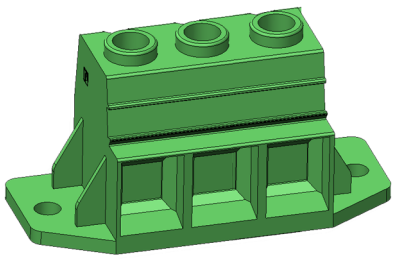
XD04 (16 mm²)

Table 104: Function, pinout, properties

View	Connection	Signal name	Function
	1	n.s.	Braking resistor connection
	2	n.s.	Braking resistor connection
Screw connection at connector	**Unit**	**min.**	**max.**
Connection cable	mm²	0.75	16
stranded wire	AWG	18	6
Stripped length	mm	12	
Tightening torque	Nm	1.7	1.8

XD04 (35 mm²)

Table 105: Function, pinout, properties

View	Marking	Function	
	PE	Equipment grounding conductor	
	2	Braking resistor	
	1	Braking resistor	
Terminal block	**Unit**	**min.**	**max.**
Connection cable	mm²	0.5	35

stranded wire	AWG	20	4
Stripped length	mm	18	
Tightening torque	Nm	2.5	4.5

XD10, 24 V supply (control voltage)

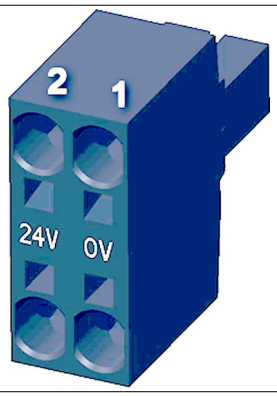
Function, pinout

Via the connection point, the 24 V supply is applied externally for

- control and power sections of the drive controller
- the brake control
- the digital inputs and the digital output

Connectors included in scope of delivery.

Table 106: Function, pinout, properties

View	Connection	Signal name	Function
	1	0V	Reference potential for power supply
	2	+24V	Voltage supply
Screw connection at connector	**Unit**	**min.**	**max.**
Connection cable	mm^2	0.2	6
stranded wire	AWG	24	8
Stripped length	mm	10	
Power consumption	W	P_{N3} (see control voltage data)	10.0
Voltage load capacity	V	U_{N3} (see control voltage data)	8
Current carrying capacity “looping through” from 0 V to 0 V, 24 V to 24 V	A	41	
Polarity reversal protection		Within the allowed voltage range by internal protective diode	
Insulation monitoring		Possible	

Installation instructions

Requirements for the connection to 24 V supply:

- Minimum cross-section: 1 mm^2
- Maximum allowed inductance: 100 µH (2 twisted single strands, 75 m long)
- Parallel line routing where possible

Depending on the power consumption of the devices and the current carrying capacity of the connector, check the number of devices through which one line for 24 V supply can be looped through. You might possibly have to connect another device directly to the 24 V supply and then loop through the control voltage from this device to other devices.

XE20, Y capacitor ground connection

Leave XE20 in its condition as supplied until Rexroth has given you approval for using it.

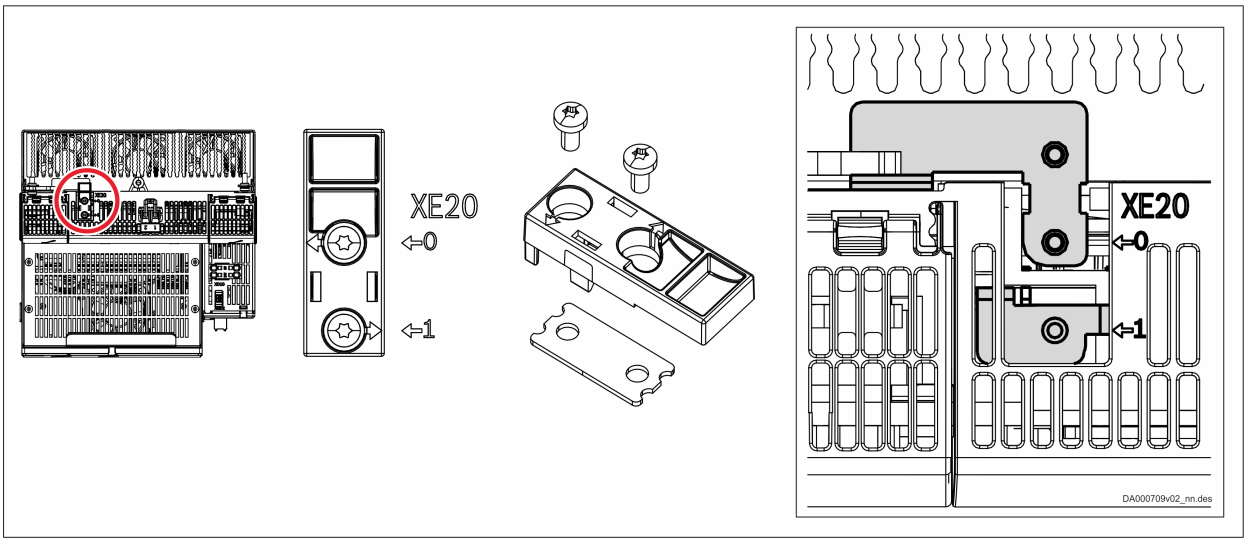
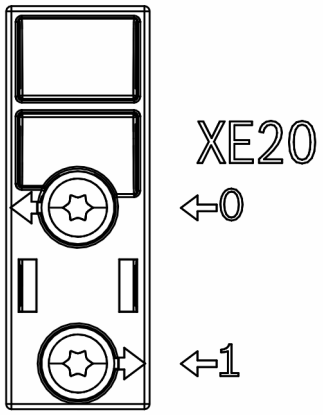
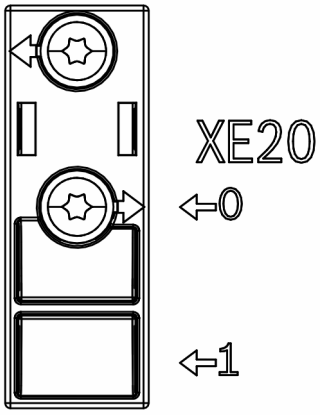


Fig. 53: XE20, Y capacitor ground connection

With ground connection	Without ground connection
 Condition as supplied	

XF21 P1, XF22 P2, communication (RJ-45)

Description

The connection point complies with IEEE 802.3 standard.

P1, P2

P1 means port 1 and P2 means port 2 etc.. Thus, the error counter of the firmware can be directly assigned to a port.

Connection

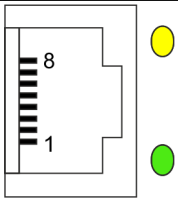
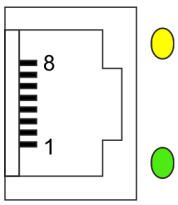
Sercos:

- Input: arbitrary
- Output: arbitrary

EtherCAT:

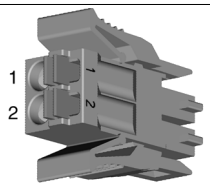
- Input: XF21 P1
- Output: XF22 P2

Table 107: Function, pinout, properties

View	Connection	Signal name	Function
 XF22 P2	8	n. c.	-
	7	n. c.	-
	6	RD-	Receive, Differential Input -
	5	n. c.	-
	4	n. c.	-
	3	RD+	Receive, Differential Input +
	2	TD-	Transmit, Differential Output -
	1	TD+	Transmit, Differential Output +
 XF21 P1	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin		
Compatibility	100Base-TX according to IEEE 802.3u		
Recommended cable type	• According to **CAT5e**; shield type ITP (Industrial Twisted Pair) • Ready-made cables available for order: – **RKB0021** Long cables (100 m at maximum) to connect the drive system to the higher-level control unit or remote communication nodes. Minimum bending radius: 48.75 mm with flexible routing 32.50 mm with permanent installation Order code for a cable with a length of 30 m: RKB0021/030,0 – **RKB0013** Short cables to connect adjacent devices in the control cabinet. Length: 0.19 m; 0.25 m; 0.35 m; 0.55 m; 1 m; 1.25 m; 2 m; 3 m; 5 m; 7 m Order code for a cable with a length of 0.55 m: RKB0013/00,55 Minimum bending radius: 30.75 mm		

XG02, Bb relay contact

Table 108: Function, pinout, properties

View	Connection	Signal name	Function
	1	Rel1	Bb relay contact signals: • Ready for operation • Inverter power enable
	2	Rel2	
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm^2	0.2	1.5
stranded wire	AWG	24	16
Stripped length	mm	10	
Loading capacity of the contacts	V		30
	A	0.01	1

Connectors included in scope of delivery.

Use

For how to use it see also ➥Chapter “Mains contactor” on page 77

XG03, Motor temperature monitoring and motor holding brake

Important notes

⚠ WARNING

Dangerous movements! Danger to persons from falling or dropping axes!

The standard equipment motor holding brake or an external holding brake controlled by the drive controller is not sufficient to guarantee personal safety!

Personal safety must be achieved using higher-ranking, fail-safe measures:

- Block off danger zones with safety fences or safety guards.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
  - mechanically securing the vertical axes
  - external braking/arrester/clamping mechanism
  - Ensuring sufficient counterweight for the vertical axes

⚠ WARNING

Lethal electric shock from live parts with more than 50 V!

The input of the motor temperature evaluation is **not** galvanically isolated from the housing. Excess voltage at the input (e.g., by the motor winding voltage flashing over) can get to the housing. Make sure that the temperature sensor of the connected motor is **double-insulated** from the motor winding.

NOTICE	**Risk of damage to device from excess voltage at motor temperature evaluation input!** Only the allowed control voltage for the device is allowed at the motor temperature evaluation input. Excess voltage at the input may damage the device.

Function

The connection point contains the connections for

- monitoring the motor temperature
- controlling the motor holding brake

Overview

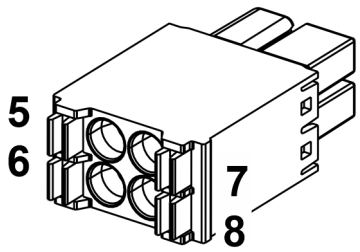
Spring terminal at connector (—⊃(▬—).

Component	XG03 (2.5 mm²) 5 6 7 8	XG03 (1.5 mm²) 5 6 7 8	XZ03[1] (1.5 mm²) 5 6 7 8
XCS	0100...W0280[2]	0054...0090[3]	0023[3]

1) Hybrid connection (motor, motor temperature monitoring and motor holding brake)
2) Connectors included in the scope of delivery
3) Connectors **not** in the scope of delivery.

XG03 (1.5 mm²)

Table 109: Function, pinout

View	Connection	Signal name	Function
	5	MotTemp+	Input Motor temperature evaluation
	6	MotTemp-	
	7	+24VBr	Output Controlling the motor holding brake
	8	0VBr	
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm²	0.2	1.5
stranded wire	AWG	24	16
Stripped length	mm	10	
Current carrying capacity of outputs XG03	A	-	2
Time constant of load	ms	-	50
Number of switching actions at maximum time constant of load		Wear-free electronic contact	
Switching frequency	Hz	-	0.5
Short-circuit protection		XG03.7 against XG03.8 (output for controlling the motor holding brake)	
Overload protection			

XZ03 (1.5 mm²)

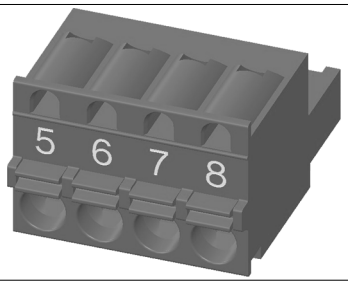
Motor holding brake: Installation instructions

Ensure a sufficient **power supply** of the motor holding brake at the motor. Observe that voltage drops on the supply line. Use connection lines with the largest possible cross section of single strands.

Use an external contact element **in accordance with the required safety category if you wish to supply motor holding brakes with higher currents than the current load allowed at the connection point.** Make sure to comply with the required minimum current consumption of 100 mA when using an external contact element. Otherwise, the brake current monitoring function will signal an error.

XG03 (2.5 mm²)

Table 110: Function, pinout

View	Connection	Signal name	Function
	5	MotTemp+	Input
	6	MotTemp-	Motor temperature evaluation
	7	+24VBr	Output
	8	0VBr	Controlling the motor holding brake

Spring terminal (connector)	Unit	min.	max.
Connection cable	mm²	0.2	2.5
stranded wire	AWG	24	12
Stripped length	mm	10	
Current carrying capacity of outputs XG03	A	-	2
Time constant of load	ms	-	50
Number of switching actions at maximum time constant of load		Wear-free electronic contact	
Switching frequency	Hz	-	0.5
Short-circuit protection		XG03.7 against XG03.8 (output for controlling the motor holding brake)	
Overload protection			

XZ03 (1.5 mm²)

⚠ WARNING

Dangerous movements! Danger to persons from falling or dropping axes!

The standard equipment motor holding brake or an external holding brake controlled by the drive controller is not sufficient to guarantee personal safety!

Personal safety must be achieved using higher-ranking, fail-safe measures:

- Block off danger zones with safety fences or safety guards.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
  - mechanically securing the vertical axes
  - external braking/arrester/clamping mechanism
  - Ensuring sufficient counterweight for the vertical axes

⚠ WARNING

Lethal electric shock from live parts with more than 50 V!

The input of the motor temperature evaluation is **not** galvanically isolated from the housing. Excess voltage at the input (e.g., by the motor winding voltage flashing over) can get to the housing. Make sure that the temperature sensor of the connected motor is **double-insulated** from the motor winding.

⚠ WARNING

Lethal electric shock due to live parts with more than 50 V!

Only operate the device

- with connected connectors (even if no lines are connected with the connectors) and
- with connected equipment grounding conductor!

NOTICE

Risk of damage to the device!

Provide strain relief for the terminals of the device in the control cabinet.

NOTICE

Risk of damage to device from excess voltage at motor temperature evaluation input!

Only the allowed control voltage for the device is allowed at the motor temperature evaluation input.

Excess voltage at the input may damage the device.

Connectors **not** included in scope of delivery.

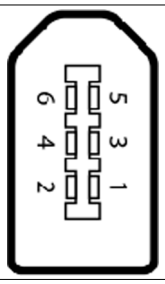
Motor holding brake: Installation instructions

Ensure a sufficient **power supply** of the motor holding brake at the motor. Observe that voltage drops on the supply line. Use connection lines with the largest possible cross section of single strands.

Use an external contact element **in accordance with the required safety category if you wish to supply motor holding brakes with higher currents than the current load allowed at the connection point.**. Make sure to comply with the required minimum current consumption of 100 mA when using an external contact element. Otherwise, the brake current monitoring function will signal an error.

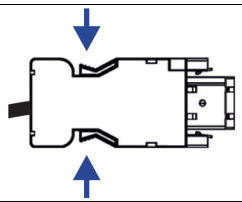
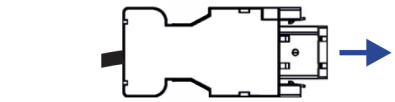
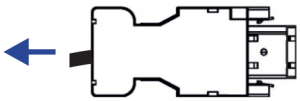
XG20, digital motor encoder connection

Table 111: XG20, digital motor encoder

View	Connection	Signal name	Function
	1	n.c.	-
	2	GND_Enc	Reference potential for power supplies
	3	+12V_Enc	12 V encoder supply
	4	n.c.	-
	5	Enc_Data+	Data transmission positive
	6	Enc_Data-	Data transmission negative
Properties	**Unit**	**min.**	**max.**
Connection cable stranded wire	mm^2	0.25	0.5
Type of encoder evaluation	ACURO®link		
	ctrlX SENSEmotor		

Connectors/cables **not** included in scope of delivery.

Table 112: Disconnecting the plug connection:

	Press the pressure keys at the sides of the connector and keep them pressed.
	Push the connector in the plug-in direction.
	Unplug the connector.

Encoder connection with hybrid cables

Hybrid cables (e.g., RHB2-021DDB) connect the drive controller to the motor (XZ03) and encoder (XG20).

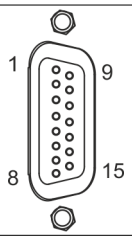
Form a loop to lead the encoder cable to the connection point XG20 so that no force is applied to the encoder connector:

Fig. 54: Encoder cable forming a loop to be led to connection point XG20

XG21, motor encoder EC (multi-encoder) (optional)

Connection point

Table 113: Function, properties

View	Identi-fica-tion	Function	
	XG21	Motor encoder connection	
D-Sub, 15-pin, female	**Unit**	**min.**	**max.**
Connection cable stranded wire	mm^2	0.25	0.5
Type of encoder evaluation		EC	

Connectors/cables **not** included in scope of delivery.

Table 114: Pinout

Connection	Signal	Function
1	GND_shld	Signal shields connection (inner shield)
2	A+	Track A analog positive
3	A-	Track A analog negative
4	GND_Encoder	Reference potential for power supplies
5	B+	Track B analog positive
6	B-	Track B analog negative
7	EncData+	Data transmission positive
	A+TTL	Track A TTL positive
8	EncData-	Data transmission negative
	A-TTL	Track A TTL negative
9	R+	Reference track positive
10	R-	Reference track negative
11	+12V	12 V encoder supply
12	+5V	5 V encoder supply
13	EncCLK+	Clock positive
	B+TTL	Track B TTL positive
14	EncCLK-	Clock negative
	B-TTL	Track B TTL negative
15	Sense-	Return of reference potential (sense cable)
	VCC_Resolver	Resolver supply
Connector housing		Outer shield

Supported encoder systems

Encoder systems with a supply voltage of **12 volt**:

- Motors MS2N AS/AM, BS/BM
- Motors MSK S1/M1, S3/M3
- HIPERFACE®
- Resolvers without encoder data memory

Encoder systems with a supply voltage of **5 volt**:

- EnDat 2.2

Motors MS2N AS/AM, BS/BM (12 V supply voltage)

Properties

Encoder systems of these MS2N motors are encoder systems HIPERFACE® (AS/AM, BS/BM).

The type code of the motor shows whether or not the encoder system supports the single-turn (xS) or multi-turn (xM) functionality. Example: The MS2N04-D0BHN-**CS**DH0-NNNN-NN motor is equipped with an ACURO®link single-turn encoder system.

Connection diagram

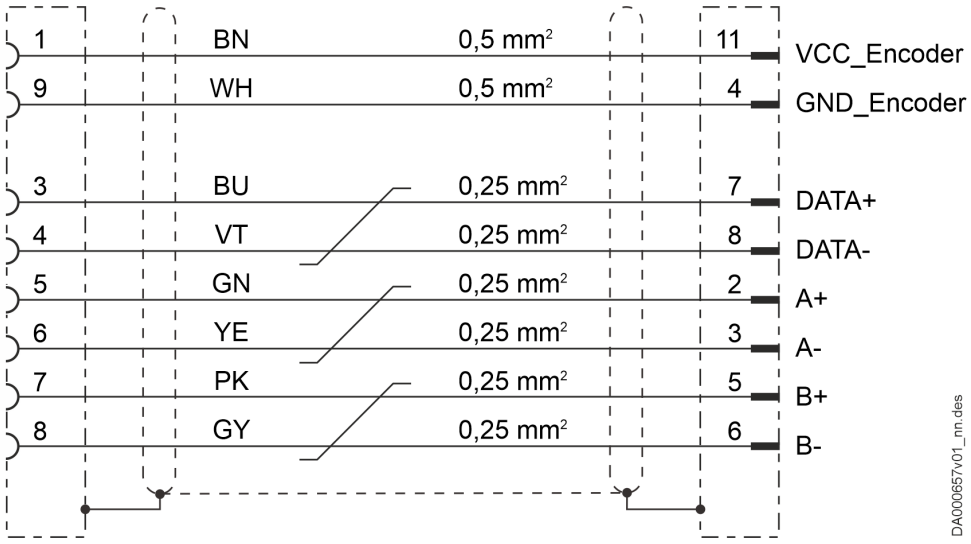


Fig. 55: MS2N encoder interface connection diagram for AS/AM, BS/BM encoder systems (encoder cable RG2-002AB...)

Encoder cable:

– HIPERFACE® (AS/AM, BS/BM):
For **direct** connection to the encoder system, use our **RG2-002AB cable:**.

Voltage supply

12 V (the voltage is made available via the EC interface)

Technical specification of the voltage supply: See ➦ Chapter “Voltage supply” on page 146

Cable length

The maximum allowed cable length depends on multiple factors and is described in chapter “Encoder cable length" in document R911386579.

HIPERFACE® (12 V supply voltage)

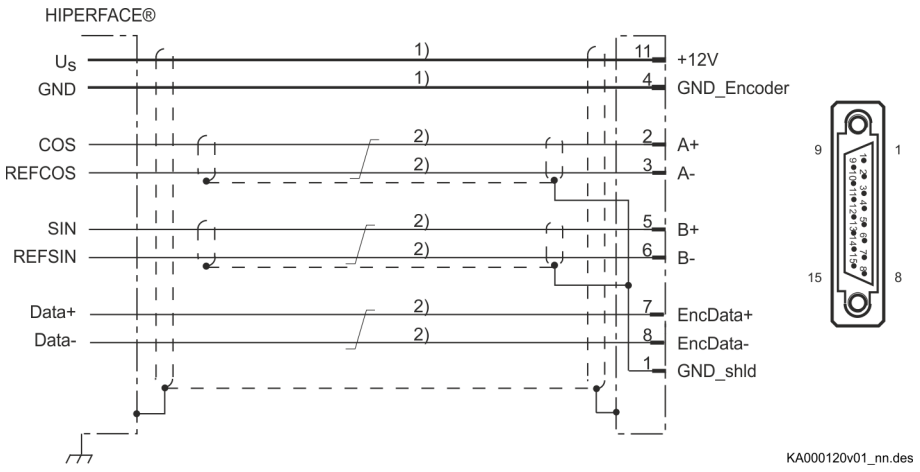


Fig. 56: HIPERFACE® encoder system connection diagram

Voltage supply

The HIPERFACE® encoder system requires a 12 V supply voltage. This supply voltage is made available via the EC interface.

Technical specification of the voltage supply: See chapter “Voltage supply” below.

Please observe that the encoder used has to be suited for the voltage available at the EC interface as the encoder supply voltage.

Resolvers without encoder data memory

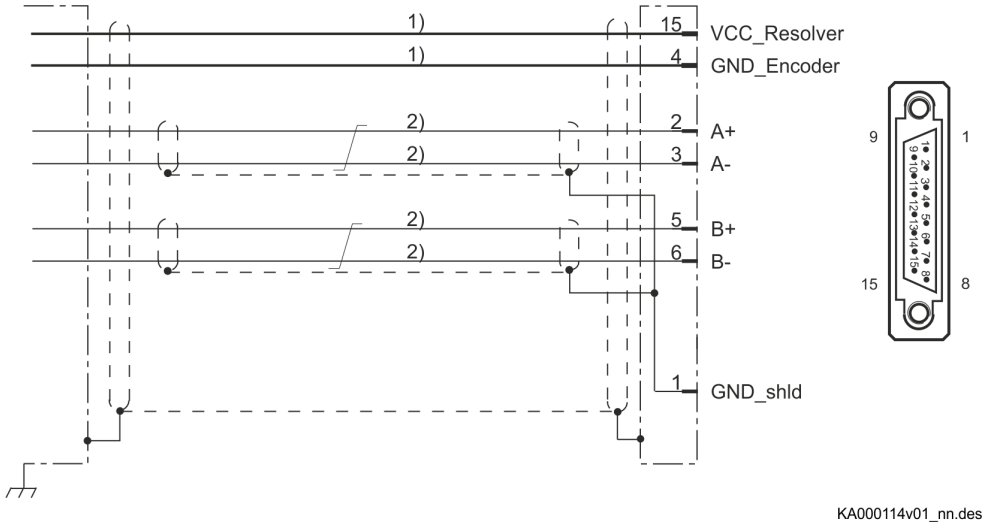


Fig. 57: EC connection diagram with resolver encoder system

Voltage supply

The EC interface supplies the resolver encoder system with a carrier voltage amplitude of 11 V_{pp}.

Technical specification of the voltage supply: See chapter “Voltage supply” below.

Please observe that the resolver encoder used has to be suited for the voltage available at the EC interface as the encoder supply voltage.

Cable length

Maximum **75 m**

Specific technical features

The encoder evaluation has been sized for resolvers with a **transfer ratio** of **0.5** .

Voltage supply

12 V voltage supply for third-party encoders

Table 115: 12 V voltage supply

Datum	Unit	min.	typ.	max.
Voltage for encoder supply	V	10.7	12	12.3
Output current	mA			500 [1]
1) The sum of the power consumptions of all connected encoder systems should not exceed 12 W.				

5 V voltage supply

Table 116: 5 V voltage supply

Datum	Unit	min.	typ.	max.
Voltage for encoder supply	V	5.0		5.25
Output current	mA			500 1)
1) The sum of the power consumptions of all connected encoder systems should not exceed 12 W.				

Resolver voltage supply

Table 117: Resolver encoder supply

Datum	Unit	min.	typ.	max.
AC output voltage VCC_Resolver (peak-peak value)	V	8.3	10	12
Output frequency sine	kHz		8	
Output current (peak value)	mA			60 1)
Output current (rms value)	mA			40 1)
1) The sum of the power consumptions of all connected encoder systems should not exceed 12 W.				

Encoder cable length

Use lines with the same line cross section for encoder supply.

Allowed encoder cable length for 12 V encoder systems

Preconditions:

- The **cross section** of the supply voltage lines is at least **0.5 mm²**
- The minimum allowed **supply voltage** at the encoder is **10 V**

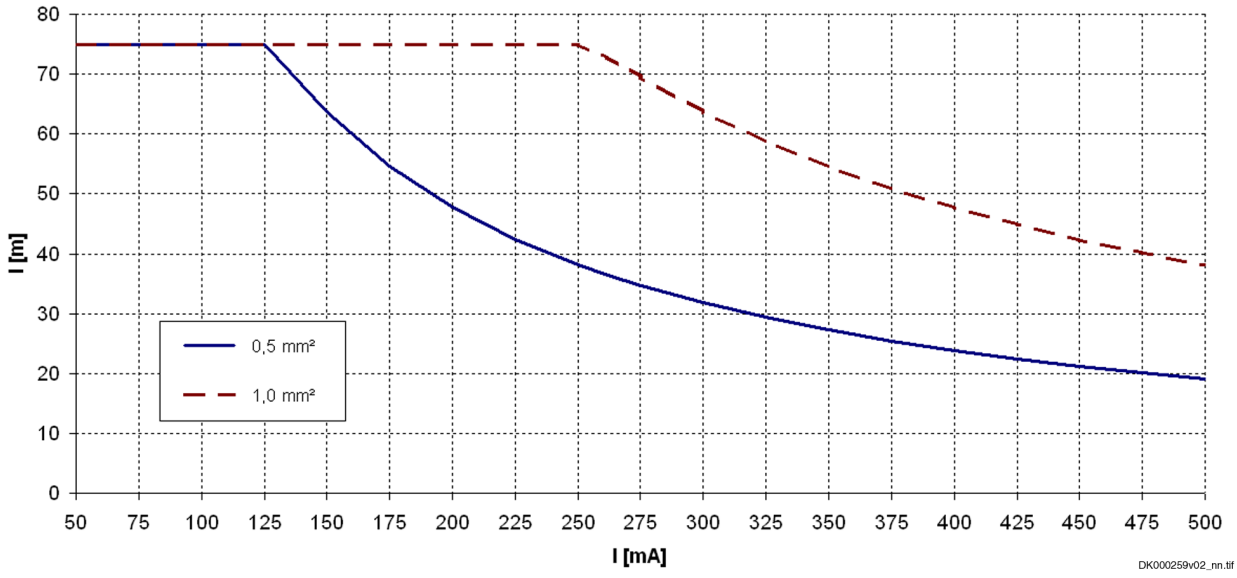


Fig. 58: Maximum allowed encoder cable lengths for 12 V encoder systems depending on the line cross-section at 10 V supply voltage

I [mA] Encoder current consumption
l [m] Cable length
0.5 mm²; 1.0 mm² Line cross sections

Nominal current consumption of the MSK motor encoders: 60 mA

Allowed encoder cable length for 5 V encoder systems without Sense function

If the encoder system used does not support the Sense function, the maximum possible cable length results from the diagram below.

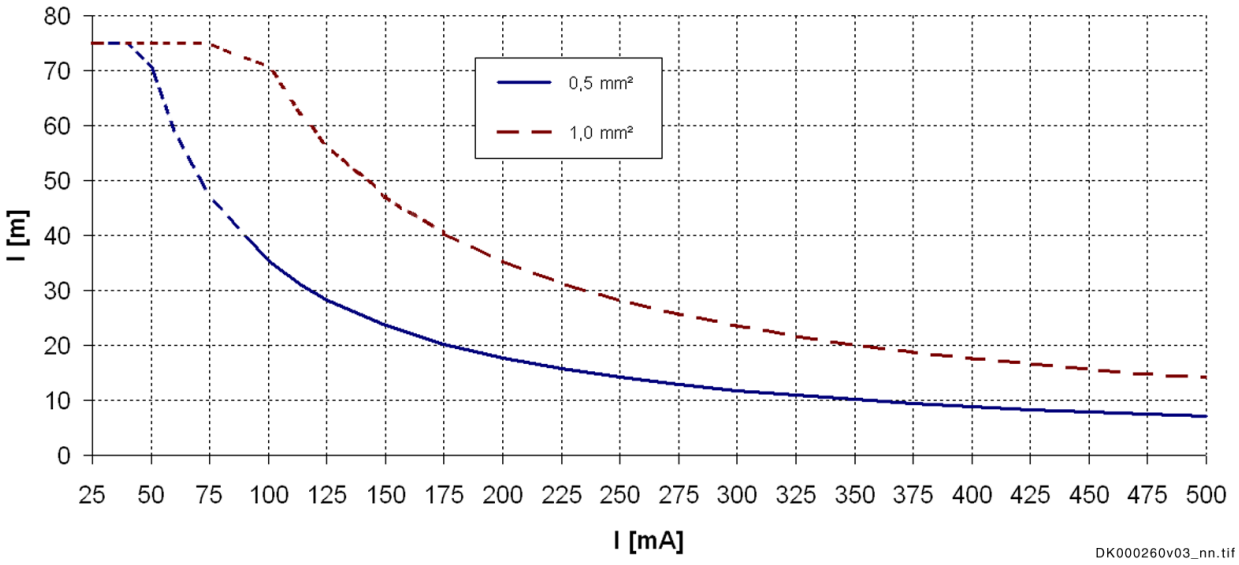


Fig. 59: Maximum allowed encoder cable lengths for 5 V encoder systems without Sense connection depending on cable cross section

I [mA]	Encoder current consumption
l [m]	Cable length
0.5 mm²; 1.0 mm²	Line cross sections

Allowed encoder cable length for 5 V encoder systems with Sense function

Maximum **75 m**

(Besides, the maximum allowed cable lengths depend on the motor size. See documentation of motor used.)

The cross section of lines for the supply voltage has to be 0.5 mm² at minimum.

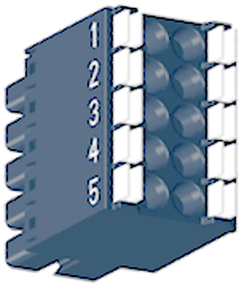
Allowed encoder cable length for resolver encoder systems

Maximum **75 m**

(The cross-section of lines for the supply voltage has to be 0.5 mm² at minimum.)

XG31, digital inputs, digital outputs, analog input

Table 118: Function, pinout, properties

View	Connection	Signal name	Function	Default assignment
	1	I_1	Digital input (type B)	Enable
	2	I_2		Controller parameter 0
	3	I_3	Digital input	Controller parameter 1
	4	0V	GND reference	-
	5	0V_100	Analog input Connection for inner cable shield	-
	6	I_4	Digital input	Master/slave switching
	7	I_5	Digital input	Error reset
	8	I_6/O_1	Digital input/output	Error
	9	I_a_1+	Analog differential input	Actual pressure value
	10	I_a_1-		

Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm^2	0.2	1.5
stranded wire	AWG	24	16
Stripped length	mm	-	10

Connectors included in scope of delivery.

The technical data can be found in technical document R911386579.

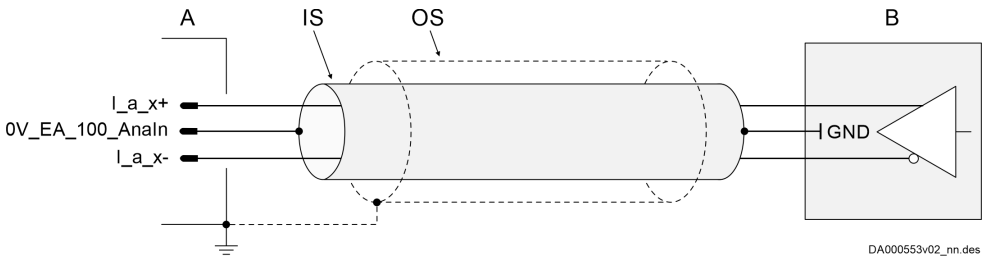
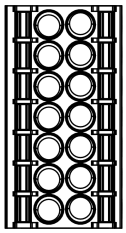


Fig. 60: Shield connection for analog inputs

A Analog input of drive controller. **Only connect the inner shield of the connection cable to the drive controller if GND has not been connected to ground in the external device.**
B External device
IS Inner shield of the connection cable
OS Overall shield of the connection cable

XG37, digital inputs, digital outputs (DA option)

Table 119: Function, pinout

Signal name[1)]	Connection	View	Connection	Signal name[1)]
IO_1	1		8	IO_3
IO_2	2		9	IO_4
I_5	3		10	O_5
I_6	4		11	O_6
I_7	5		12	O_7
I_8	6		13	O_8
24V_EA	7		14	0V_EA
1) IO: Input/output; I: Input; O: Output				

The technical data can be found in document R911386579.

Table 120: Properties

Spring terminal (connector)	Unit	min.	max.
Connection cable stranded wire	mm^2	0.2	1.5
AWG		24	16
Stripped length	mm	-	10

Connectors included in scope of delivery.

XG38, analog inputs, analog outputs (DA option)

Table 121: Function, pinout

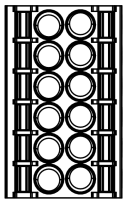
Signal name[1)]	Connection	View	Connection	Signal name[1)]
I_a_1+ (flow command value)	1		7	I_a_1-
I_a_2+ (pressure command value)	2		8	I_a_2-
I_a_3+ (slave speed)	3		9	I_a_3-
0V_EA_100_AnaOut	4		10	0V_EA_100_AnaIn
O_a_1 (pressure feedback value)	5		11	O_a_2 (speed feedback value)
0V_EA_Ana	6		12	0V_EA_Ana
				1) I: Input; O: Output

Table 122: Properties

Spring terminal (connector)	Unit	min.	max.
Connection cable stranded wire	mm^2	0.2	1.5
AWG		24	16
Stripped length	mm	-	10

Connectors included in scope of delivery.

The technical data can be found in document R911386579.

Shield connection for analog inputs

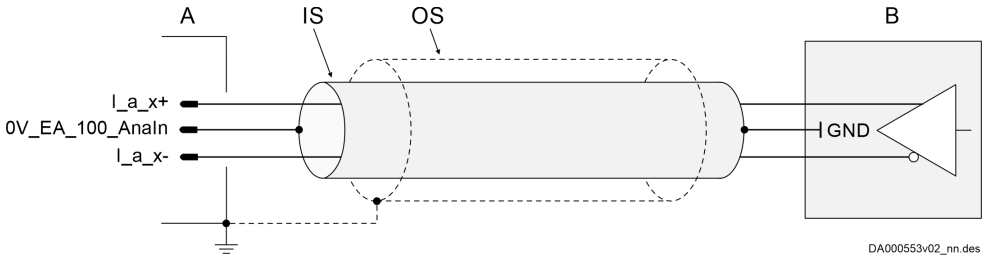


Fig. 61: Shield connection for analog inputs

A Analog input of drive controller. **Only connect the inner shield of the connection cable to the drive controller if GND has not been connected to ground in the external device.**
B External device
IS Inner shield of the connection cable
OS Overall shield of the connection cable

Shield connection for analog outputs

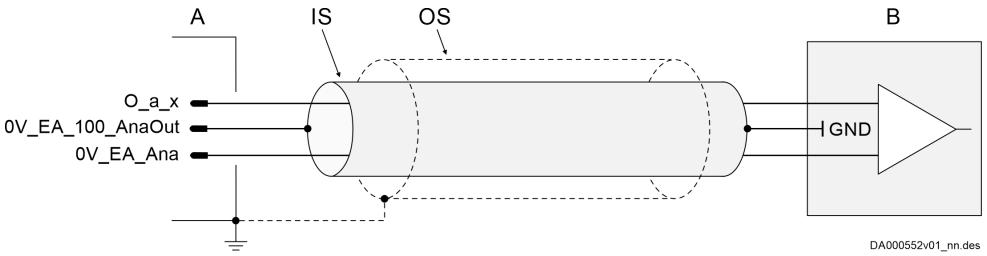
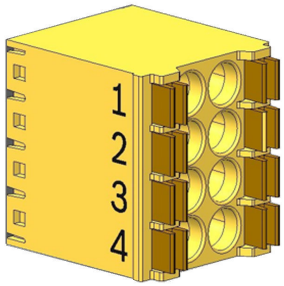


Fig. 62: Shield connection for analog outputs

A Analog output of drive controller
B External device. **Only connect the inner shield of the connection cable to the external device if GND has not been connected to ground in the external device.**
IS Inner shield of the connection cable
OS Overall shield of the connection cable

XG41, safety technology Safe Torque Off

Table 123: Single-axis

View	Connection	Signal name	Function
	1	STO_DynOut_CH1	Channel 1 dynamization output
	2	-	n. c.
	3	STO_CH1	Input for selection of channel 1
	4	STO_CH1	Input for selection of channel 1
	5	STO_DynOut_CH2	Channel 2 dynamization output
	6	-	n. c.
	7	STO_CH2	Input for selection of channel 2
	8	STO_CH2	Input for selection of channel 2
Spring terminal (connector)	**Unit**	**min.**	**max.**
Connection cable	mm^2	0.2	1.5
stranded wire	AWG	24	16
Stripped length	mm	-	10

Connectors included in scope of delivery.

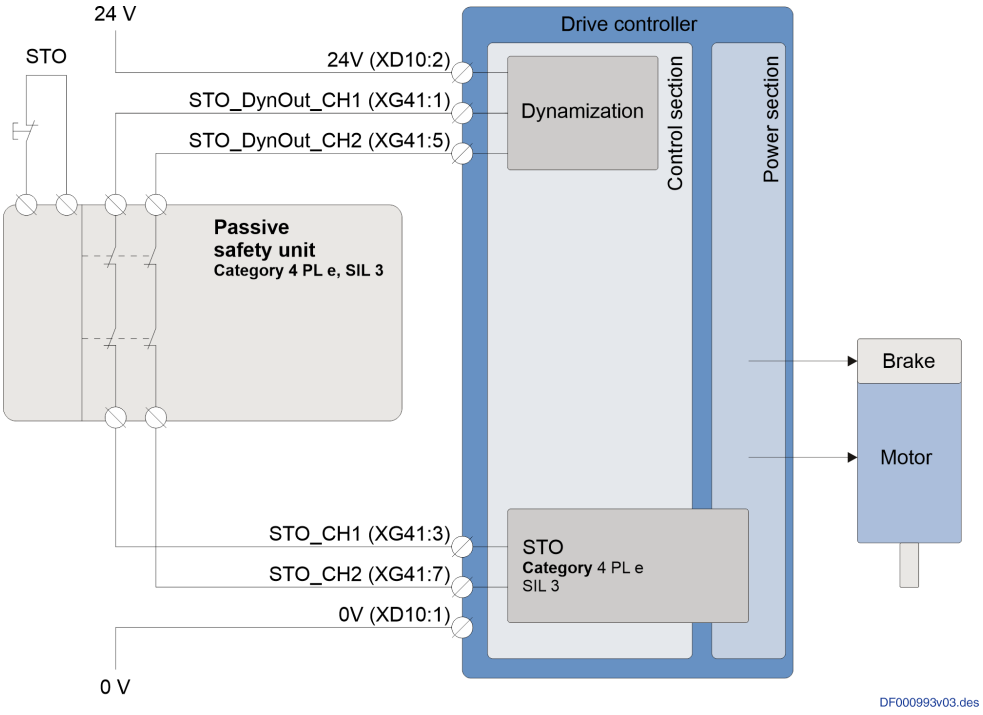


Fig. 63: Example of dual-channel wiring

Further wiring examples can be found in Application Manual R911383774.

8 Commissioning

⚠ WARNUNG	**Working in the danger zone of a machine or system!** Risk of severe injury due to unsafe working. The machine or system may only be commissioned when safe working is ensured. – Pay attention to and eliminate potential danger sources before commissioning the machine or system. – Nobody may stand in the danger zone of the machine or system. – The emergency stop button for the machine or system must be within the operator's reach. – Always strictly observe the instructions of the machine or system manufacturer during commissioning.
⚠ WARNING	**Uncontrolled system behavior!** Non-connected electrical and hydraulic connections can cause malfunctions and hydraulic fluid jets to be ejected, which can injure you. – Only commission a completely installed product.
NOTICE	**Missing seals and plugs!** Loss of protection class! Liquids and foreign particles may penetrate and damage the product. – Before commissioning, make sure that all seals and plugs of plug-in connections are tight.
NOTICE	**Ingress of dirt!** Damage to the Sytronix system! Contamination of the hydraulic fluid results in wear and malfunction. Especially foreign bodies such as welding beads and metal chips in the hydraulic lines can damage the Sytronix system. – Observe utmost cleanliness during commissioning. – Make sure that no contaminants penetrate when closing the measuring ports.
NOTICE	**Insufficient hydraulic fluid!** Insufficient amounts of hydraulic fluid can lead to destruction of the product. – Make sure that the housing of the Sytronix system is filled with hydraulic fluid during commissioning and in operation. This must also be observed during longer periods of standstill, because the Sytronix system may drain via the hydraulic lines.

8.1 Initial commissioning

When carrying out any work in conjunction with commissioning of the Sytronix system, observe the general safety instructions and intended use in chapter 2 “Safety instructions“.

8.1.1 Filling the Sytronix system

NOTICE

Spilled hydraulic fluid!

Discharging or spilling hydraulic fluid while filling the Sytronix system can lead to environmental pollution and contamination of the groundwater.

- When filling in and changing the hydraulic fluid, always place an oil drain pan under the Sytronix system.
- Observe the information in the safety data sheet for the hydraulic fluid and the instructions provided by the system manufacturer.

You will require an approved hydraulic fluid: The machine or system manufacturer can provide you with precise data of the hydraulic fluid.

8.1.2 Commissioning of the pump

General information on how to commission the pump

When commissioning the internal gear pumps PGH/PGH/PGM or axial piston units A10FZO, respectively, observe the operating instructions for the hydraulic system.

Commissioning of the pump requires knowledge in the field of mechanical systems and hydraulics.

- Only a qualified expert may commission the pump.

If the pump has not been mounted correctly, persons may be injured and the product or system can be damaged during commissioning of the pump.

- Ensure correct mounting of the pump by qualified personnel before you commission the pump.

Preparing commissioning

- Make sure that fluid can be aspired via the suction channel without any obstructions.
- Inspect the mounting elements for proper fit.
- Check the hydraulic fluid reservoir for cleanliness.
- Fill the system with hydraulic fluid according to the manufacturer’s instructions. Use filters with the required minimum retention rate.
- Make sure that the piping is clean and tightly mounted.
- Make sure that the direction of rotation of the motor corresponds to the direction of rotation of the pump. If the shaft cannot be seen, operate the pump in the jog mode to see, whether pressure builds up (display in IndraWorks)
- If pressure builds up, check the direct functions/movements on the basis of a hydraulic circuit diagram.

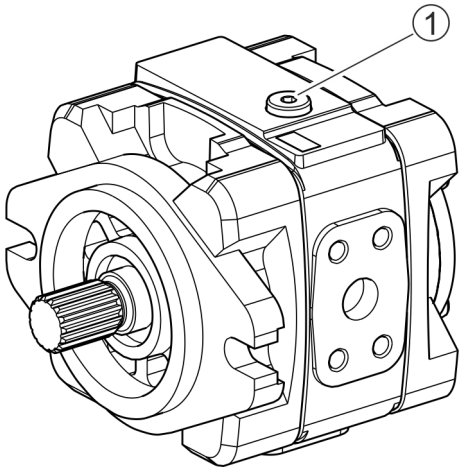


Fig. 64: Bleed port of gear pump PGH/PGM
1 Plug screw G1/4” for test port (figure shows PGH4).

1. Check the lines for wear and damage before every startup.
2. In the case of an internal gear pump, fill the pressure side with filtered hydraulic fluid. This is carried out via the suction, the pressure or the test port (see figure above) depending on the installation orientation. In the case of an axial piston unit, fill the housing of the pump with hydraulic fluid. For information regarding a suitable connection, please refer to the operating instructions of the system.
3. Bleed the pump as described in the data sheet of the pump.

8.1.3 Commissioning of the drive controller

The connection to the drive as well as commissioning with the help of the engineering software IndraWorks Ds is described in detail in functional description RE 62312-FK.

8.2 Recommissioning after standstill

Depending on the installation and ambient conditions, changes may occur in the system which make recommissioning necessary. Among others, the following criteria may result in the necessity for recommissioning:

- Air in the hydraulic system
- Water in the hydraulic system
- Aged hydraulic fluid
- Other contamination

For recommissioning proceed as described in "Initial commissioning" above.

9 Operation

⚠ CAUTION	**Overheating!** Risk of burning at hot components due too poor dissipation of heat as a result of dirt, dust and mist deposits on the Sytronix system. – Regularly remove dust and dirt accumulations from the Sytronix system.

9.1 General

- Ensure that the specified ambient conditions are adhered to during operation.
- Pay attention to noise, temperature and vibration on the system.
- After some time in operation, inspect the hydraulic fluid in the tank for the formation of bubbles or foam on the surface.

Changes in the operating speed, temperature, increasing noise or high energy consumption are signs of wear or damage to the machine or the Sytronix system. In the case of any changes, proceed as described in ➦ Chapter 14 “Troubleshooting” on page 173.

9.2 Operating mode

The system automatically switches to the standby/parameter mode after each restart, if no error is detected or generated during starting.

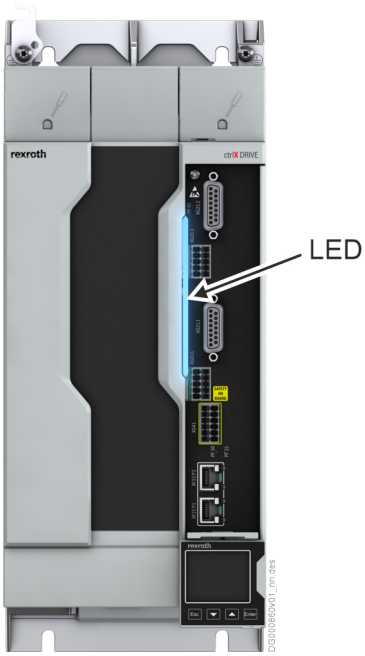
9.3 Error mode

If an error or a warning occurs, eliminate the cause of error. Then you can acknowledge the error message as follows:

- Press the [ESC] key
- Set digital input 5 at XG31.7 to high level

9.4 LED PF01 (device state)

PF01 LED



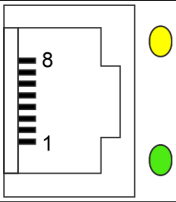
With different colors and flashing patterns, the LED shows the state of the device and the state of the optional internal control.

Descriptions of colors and flashing patterns: See documentation for firmware ctrlX DRIVE, Diagnostic Messages of Runtime AXS, Reference Book (R911383776) or Diagnostic Messages of the Runtime AXS-V-03VRS (R911409808).

9.5 Sercos/EtherCAT

9.5.1 Display elements

Table 124: Display elements

LED	Meaning
	Port LED, 1 × yellow, 1 × green
	Diagnostic LED, multicolor

The LED display depends on the fieldbus system

9.5.2 Port LED

EtherCAT

EtherCAT has only one active LED per port.

Table 125: Port LED

LED: Color / flashing pattern	Meaning
 Off	No connection
 Permanently lit green	Connection to network available, but no telegram exchange (EtherCAT bus inactive)
 Flashing green	Connection to network available with telegram exchange (EtherCAT bus active)

Sercos

Table 126: Port LED

LED: Color / flashing pattern	Meaning
 Off	No connection No data transmission
 Permanently lit yellow	Data transmission running
 Permanently lit green	Connection to network available

9.5.3 Diagnostic LED

EtherCAT

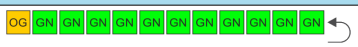
Table 127: Diagnostic LED

LED: Color / flashing pattern [1]	Meaning	Description
 Off	Status INIT	• Cyclic process data and acyclic data channel are not transmitted • No error
 Flashing green	Status PRE-OPERATIONAL	Acyclic data channel is transmitted
 Green, single flash pattern	Status SAFE-OPERATIONAL	Acyclic data channel is transmitted
 Permanently lit green	Status OPERATIONAL	Cyclic process data and acyclic data channel are transmitted
 Flashing red	Configuration error	General EtherCAT configuration error
 Red, single flash pattern	Synchronization error	• The drive controller has not been synchronized to the EtherCAT master • Communication error of the drive controller
 Red, double flash pattern	Timeout - watchdog	• Timeout while cyclic process data are monitored • Watchdog of the EtherCAT master
1) Flashing pattern: One square corresponds to a duration of 200 ms; the arrow marks the end of a cycle GN = LED is permanently lit green RD = LED is permanently lit red -- = LED is off		

Sercos

Table 128: Diagnostic LED

LED: Color / flashing pattern [1]	Description	Prio [2]
Off	NRT mode (no Sercos communication) [3]	6
permanently lit orange	CP0 (communication phase 0 active)	6
 flashing orange/green	CP1 (communication phase 1 active)	6
 flashing orange/green	CP2 (communication phase 2 active)	6
 flashing orange/green	CP3 (communication phase 3 active)	6
Permanently lit green	CP4 (communication phase 4 active)	6
 flashing orange/green	HP0 (hot-plug phase 0 active)	6

LED: Color / flashing pattern [1]	Description	Prio [2]
 flashing orange/green	HP1 (hot-plug phase 1 active)	6
 flashing orange/green	HP2 (hot-plug phase 2 active)	6
 Flashing green	Transition from Fast forward to Loopback	5
 flashing red/orange	Application error (sub-device/device error [C1D])	4
 Flashing red-green	MST Warning [4] (S-0-1045, Sercos: Device status word [S-Dev], bit15)	3
 Permanently lit red	Communication error (sub-device/device error [C1D])	2
 flashing orange	Identification (S-0-1044, Sercos: Device Control [C-Dev], bit15)	1
 flashing red	Internal watchdog	0

1) Flashing pattern: One square corresponds to a duration of 250 ms; the arrow marks the end of a cycle; abbreviations on the squares: GN = LED permanently lit green, OG = LED permanently lit orange, RD = LED permanently lit red, -- = LED is off

2) Display priority (1 = highest priority); the state of the highest priority is displayed

3) NRT = None Real Time

4) MST = Master synchronization telegram

10 Maintenance and repair

10.1 Cleaning and care

NOTICE

Solvents and aggressive cleaning agents!

Aggressive cleaning agents may damage the seals and the surface of the Sytronix system and let them age faster.

– Never use solvents or aggressive cleaning agents.

For cleaning and care of the Sytronix system, observe the following:

- Plug all openings with suitable protective caps/devices.
- Check that all seals and plugs of the plug-in connections are securely seated to ensure that no moisture can enter the Sytronix system during cleaning.
- Use only water and, if necessary, a mild cleaning agent to clean the Sytronix system.
- Remove external coarse dirt and keep sensitive and important parts and displays clean.

10.2 Inspection

10.3 Maintenance

Sytronix systems require little maintenance when used as intended.

10.3.1 Motor-pump unit

See documentation for the motor-pump unit

Table 129: Documentation

Title	Material number	Type of documentation
Sytronix SVP70xx Motor-Pump Unit MPA02	R911387041	Operating instructions

This documentation contains information on supplementary documentations of the individual components (motors, pumps, hydraulic fluids, etc.).

10.3.2 Drive controller

Regularly check the filters at the air inlets of the control cabinet. Replace or clean clogged filters.

The electrical components are maintenance-free.

10.4 Repair

Rexroth offers a comprehensive range of services for repairing Rexroth Sytronix systems. Repairs of the Sytronix system may only be performed by authorized, skilled and instructed staff.

10.5 Spare parts

When ordering spare parts, please state the material number of the relevant spare parts. On some components, the material number is shown on a nameplate or a label.

Please address all questions regarding spare parts to your responsible Rexroth Service partner.

Bosch Rexroth AG Service Industriehydraulik

Bürgermeister-Dr.-Nebel-Straße 8

97816 Lohr am Main

Germany

Telephone +49 (0) 9352/40 50 60

E-mailservice@boschrexroth.de

Outside Germany you will find service subsidiaries in your vicinity on the Internet at ➦ https://www.boschrexroth.com

Please state the following data from the nameplate on your order:

- Material number
- Serial number
- Production job order number
- Date of production

11 Decommissioning

The Sytronix system is a component that does not require decommissioning. For this reason, this chapter of the present instructions does not contain any information. How to demount and replace your Sytronix system is described in the chapter “Demounting and replacement“ below.

12 Demounting and replacement

⚠ CAUTION	**High voltage!** Risk of electric shock by contact with live parts! – Disconnect all parts of the system from the power supply.

12.1 Required tools

The product can be demounted using standard tools. No special tools are necessary.

12.2 Preparing demounting

1. Decommission the entire system as described in the general instructions for the machine or system.
2. Depressurize the hydraulic system according to the instructions of the machine or system manufacturer.

12.3 Demounting

NOTICE	**Spilled hydraulic fluid!** Discharging or spilling hydraulic fluid while filling the Sytronix system can lead to environmental pollution and contamination of the groundwater. – When filling in and changing the hydraulic fluid, always place an oil drain pan under the Sytronix system. – Observe the information in the safety data sheet for the hydraulic fluid and the instructions provided by the system manufacturer.

Proceed as follows to demount the Sytronix system:

1. Make sure that the hydraulic system is depressurized and the Sytronix components are disconnected from the power supply.
2. Check that the Sytronix system has cooled down sufficiently so that it can be removed without any risks.
3. Loosen the lines and collect the escaping hydraulic fluid in the collector provided for this purpose.
4. Demount the Sytronix system. Use suitable lifting gear for this.
5. Drain the Sytronix system completely.
6. Plug all openings.

12.4 Preparing the components for storage or further use

Proceed as described in ➦Chapter 6 “Transport and storage” on page 35.

13 Environmental protection and disposal

13.1 Environmental protection

Production processes

The products are manufactured in energy- and resource-optimized production processes which allow the resulting waste to be re-used and recycled. We regularly try to replace pollutant-loaded raw materials and supplies by more environment-friendly alternatives.

No release of hazardous substances

Our products do not contain any hazardous substances which may be released in the case of intended use. Normally, our products will not have any negative influences on the environment.

Essential components

Basically, our products contain the following components:

Electronic devices	Motors
· Steel	· Steel / stainless steel
· Aluminum	· Aluminum
· Copper	· Copper
· Plastics	· Brass
· Electronic components	· Magnetic materials

13.2 Disposal

Return of products

Products manufactured by us can be returned to us free of charge for disposal. However, this requires that the products be free of oil, grease or other dirt.

Furthermore, the products returned for disposal may not contain any undue foreign material or foreign components.

Send the components free domicile to the following address:

Bosch Rexroth AG

Service Industriehydraulik

Bürgermeister-Dr.-Nebel-Straße 8

D-97816 Lohr am Main

Packaging

Packaging materials consist of cardboard, plastics, wood or polystyrene. They can be recycled anywhere without any problem.

For ecological reasons, please refrain from returning the empty packages to us.

Batteries and accumulators

Batteries and accumulators can be labeled with this symbol.

The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin.

End users in the EU are legally bound to return waste batteries. Outside the scope of the EU Directive 2006/66/EC, the applicable regulations must be followed.

Waste batteries may contain hazardous substances which can harm the environment or human health when improperly stored or disposed of.

After use, the batteries or accumulators contained in Rexroth products must be returned to the country-specific collection systems for proper disposal.

Recycling

Due to the high share of metals the material of the products can mostly be recycled. In order to recycle the metal in the best possible way, the products must be disassembled into individual assemblies.

Metals contained in electrical and electronic assemblies can also be recycled by means of special separation processes.

Plastic parts of the products may contain flame retardants. These plastic parts are labeled according to EN ISO 1043. They have to be recycled separately or disposed of according to the applicable legal provisions.

14 Troubleshooting

The following table may assist you in troubleshooting. This table is not exhaustive. In practice, problems which are not listed here may also arise.

14.1 How to proceed for troubleshooting

- Always work systematically and purposefully, even when under time pressure. Random and imprudent disassembly and changing of settings can, in the worst-case scenario, result in the inability to determine the original cause of error.
- First obtain a general overview of how your product works in conjunction with the entire system.
- Try to find out whether the product has functioned properly in conjunction with the overall system before the fault occurred.
- Try to determine any changes of the overall system in which the product is integrated:
  - Did the operating conditions or the range of application of the product change?
  - Were there any changes (e.g. retrofit) or repairs carried out on the complete system (machine/system, electrical system, control) or on the product? If yes: What were they?
  - Was the product or machine used as intended?
  - How did the fault become apparent?
- Try to get a clear idea of the error cause. If possible, ask the direct (machine) operator.
- If you cannot rectify the error, contact one of the contact addresses which can be found at: ➦www.boschrexroth.com/addresses

14.2 Error/diagnostic message memory in the drive controller ctrlX DRIVE

For diagnostic purposes the Sytronix system is provided with an internal error and diagnostic message memory. To open the error memory of the drive controller ctrlX DRIVE, select “Diagnosis” in IndraWorks Ds. → Diagnostic trace”.

14.3 Errors and warnings

The hydraulic or systemic error and warning messages are described in functional description RE 62312-FK.

14.4 Fault table

Malfunction	Possible cause	Remedy
Message F2270 Wire break monitoring	The signal of the pressure transducer falls below the threshold for wire break detection.	Test actual pressure value signal (wire rupture, working range, signal type, polarity)
Humming noise in the pressure control or fluctuations in pressure/flow	Air pocket around the sensor	Completely bleed pump and pipes.
	Shield connection problem	Motor cable shield connection
	Incorrect equipment grounding connection in the control cabinet	Properly connect equipment grounding connector
	Unfavorable place of installation/mounting technique for the pressure transducer	Change place of installation (e.g. suspended mounting, no minimess line, no throttling point between pump and pressure transducer)

Malfunction	Possible cause	Remedy
	Unsuitable control parameters for pressure or speed controller	Check controller settings
Screaming noise	Oil level in the tank too low; pump partly aspires air	Top up oil
	Suction line leaky	Seal suction line
	Pump cavitates when pressure is reduced Diagnostics: Measure, whether pressure undershoots < 1 bar occur when pressure is reduced in the pressure line	Optimize controller, reduce the command value via a ramp or in steps Minimize negative I-term Reduce pressure controller gain
	Fluid in the tank mixed with air; cooling and/or filtration circuit leaky	Seal
Other unusual noise	Input speed too high	Contact machine or system manufacturer
	Wrong direction of rotation	Check configuration of direction of rotation
	Insufficient suction conditions, e.g. air in the suction line, insufficient diameter of the suction line, viscosity of the hydraulic fluid too high, suction height too great, suction pressure too low, foreign body in the suction line	Check, whether shut-off valves are open
		Machine or system manufacturer (e.g. optimize inlet conditions, use suitable hydraulic fluid)
		Bleed hydraulic system completely, fill suction line with hydraulic fluid
	Improper mounting of the motor-pump unit	Check mounting of the motor-pump unit according to the instructions given by the machine or system manufacturer. Observe tightening torques
	Improper mounting of attachment parts, e.g. coupling and hydraulic lines	Mount attachments in accordance with the instructions of the coupling or fitting manufacturer
	Air in the pump	Bleed the pump
	Wear/mechanical damage to the control system	Replace control system, contact Rexroth Service
No or insufficient pressure(< 4 bar)	Faulty mechanical drive (e.g. defective coupling)	Contact Rexroth Service
	Hydraulic fluid not within the optimum viscosity range	Use suitable hydraulic fluid (machine or system manufacturer)
	Drive unit defective (e.g. motor)	Contact machine or system manufacturer
	Wear/mechanical damage (e.g. pump)	Replace Sytronix system, contact Rexroth Service
Pressure too low	Actual pressure value acquisition incorrectly configured	Check actual pressure value in IndraWorks and, if required, correct configuration of actual pressure value acquisition
		Replace pressure transducer

Malfunction	Possible cause	Remedy
		Change the place of installation of the pressure transducer (where appropriate, close to the actuator)
	Pressure transducer defective/not connected Diagnostics: Measure signal from pressure transducer and compare with indication on the pressure gauge	Connect or replace pressure transducer
	Control system does not work in closed-loop pressure control	Check whether speed limitation input is too low. If necessary, increase speed limitation
		Check that the hydraulic system is leak-free and there is no excessive oil consumption
Pressure too high	Actual pressure value acquisition incorrectly configured	Check actual pressure value in IndraWorks and, if required, correct configuration of actual pressure value acquisition
		Replace pressure transducer
	Pressure transducer defective/not connected Diagnostics: Measure signal from pressure transducer and compare with indication on the pressure gauge	Connect or replace pressure transducer
Insufficient flow	Pressure controller active	Increase pressure command value
	Drive speed too low	Contact machine or system manufacturer
	Damage to the pump (excessive pump leakage)	Contact Rexroth Service
	Wear/mechanical damage to the Sytronix system	Replace Sytronix system, contact Rexroth Service
Actuator switches off due to overloading	Incorrect configuration of motor parameters	Check setting and motor parameters
Drive switches off due to overloading	Generator mode while pressure is reduced results in overvoltage in the DC bus	Check connection and dimensioning of braking resistor
Hydraulic fluid temperature too high	Inlet temperature at Sytronix system too high	Inspect system, e.g. for malfunction of the cooler, insufficient hydraulic fluid in the tank
	Wear of Sytronix system	Replace control system, contact Rexroth Service

15 Service and support

To provide fast and optimum support we have a closely meshed worldwide service network. Our experts will assist you with all kinds of inquiries. You can reach us **around the clock - even on weekends and holidays**.

Service Germany and spare parts

Our technology-oriented Competence Center covers al service-related issues.

You can reach our **Service hotline** and our **Service Helpdesk** at:

Phone:	**+49 (0) 9352/40 50 60**
E-mail:	➦service@boschrexroth.de
Internet:	➦http://www.boschrexroth.com

Our websites provide supplementary information on service, repair (e.g. delivery addresses) and training.

Service worldwide

Outside Germany, please first get in touch with your personal contact. The hotline numbers can be found in the contact information on the Internet.

Required information

We can provide fast and efficient assistance, if you have the following information at hand:

- A detailed description of the fault and the circumstances
- Details on the nameplate of the affected products, especially type code and serial number
- Your contact details (phone and fax number, e-mail address)

Headquarters

Bosch Rexroth AG

Zum Eisengießer 1

97816 Lohr am Main

Telephone: +49 (0) 9352/18-0

E-Mail: my.support@boschrexroth.com

The addresses of our sales and service network and sales organizations can be found at ➦www.boschrexroth.com/adressen

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